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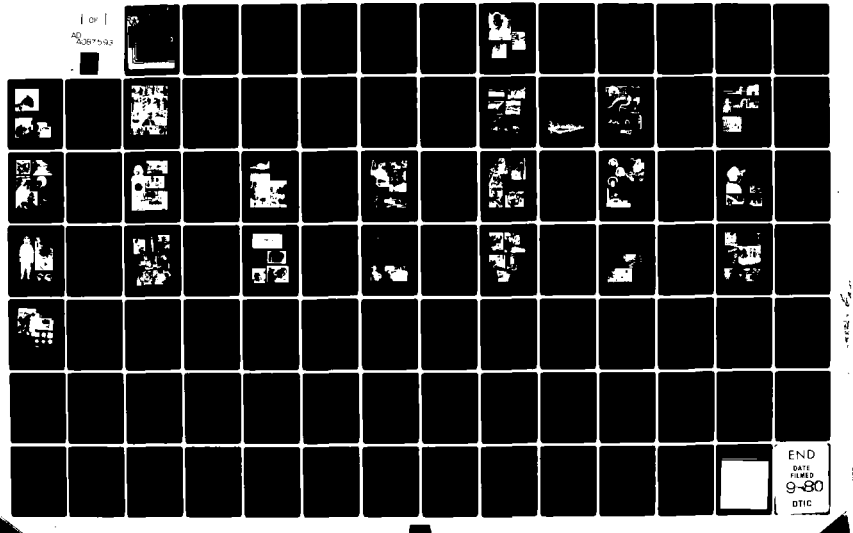

LEVEL II

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ANNUAL PROGRESS REPORT
1 October 1978 - 30 September 1979

Reported By:

Stanley C. Knapp, Colonel, MC
Commander

November 1979

U.S. ARMY AEROMEDICAL RESEARCH LABORATORY
FORT RUCKER, ALABAMA 36362

USAARL

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20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

The annual progress report gives the FY 79 personnel and funding strength of the laboratory. It outlines the eight scientific programs being pursued by the laboratory. Those programs are: acoustics; biomedical aspects of vibration; visual physiology and psychophysics; sustained aviation operations, crew workload, and stress; impact physiology in support of crashworthiness and personal armor development; health hazard assessment; medical aspects of crew selection; and thermal analysis. The DD 1498s under which this work was authorized are in Appendix A. The FY 79 publications and presentations are in Appendix B.

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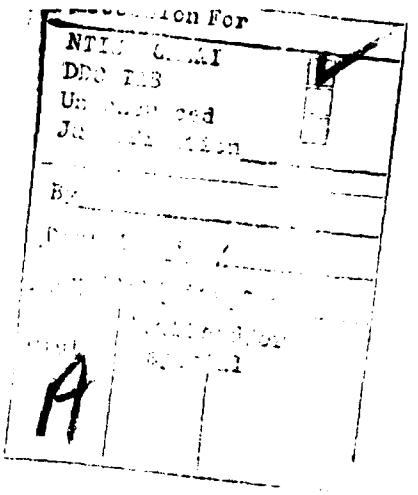

Preface

The U.S. Army Aeromedical Research Laboratory (USAARL) is a Class II medical research laboratory of the U.S. Army Medical Research and Development Command (USAMRDC), Office of The Surgeon General. USAARL is a tenant organization at the United States Army Aviation Center, Fort Rucker, Alabama.

The USAARL was established in 1962 to accomplish research in support of the Army aviation community and airborne activities. Additional mission areas were added to the laboratory and transferred at the closing of the Fort Knox laboratory in 1974 and are reflected in the mission statement. The laboratory's mission has expaned even further in recent years to include the assessment of the medical impact of advanced armor and artillery weapons systems and other nonmedical materiel.

The U.S. Army Aviation Center, with its large concentration of human and equipment resources, provides our laboratory personnel with an ideal environment in which to remain abreast of Army aviation developments. In turn we can provide the expertise early on in the development stages as well as provide immediate and direct support to deal with operational problems that may arise.

Other activities concerned with aviation research and development are in close proximity to USAARL. Together these organizations form the U.S. Army Aviation Center Team.

USAARL maintains close liaison with aviation medicine research laboratories of other U.S. Armed Forces as well as those from the civilian community. Assistance and cooperative efforts with other agencies enhance the research efforts of all the agencies concerned.

USAARL also maintains close coordination with foreign governments of NATO countries on aviation medicine matters through its involvement with the Advisory Group for Aerospace Research and Development (AGARD), a NATO organization.

USAARL's research is recognized internationally by the operational and aeromedical communities. The men and women at USAARL take pride that their work is predicated on the needs of the soldier, and that the answers and solutions provided are relevant and timely to the operational needs of soldiers.

Mission Statement

Participates in the preservation and enhancement of the health, safety, combat effectiveness, and survivability of the soldier. Conducts life sciences research, development, test, and evaluation in health hazard prevention technologies and aviation medicine concerning human tolerance, survivability, and combat crew effectiveness related to combat vehicles, weapons systems, and operations. Develops, maintains, and applies minimum bases and technologies needed to establish human tolerance and exposure relationships for fire, noise, vibration, impact, and optical hazards, and, complementing other USAMRDC elements, physiological and psychological stressors. Develops and validates technologies for assessment of and protection from these health hazards. Validates those relationships in order to recommend exposure and health effects criteria. Assembles and maintains the psychophysiologic data base required to define operational envelopes for crew safety and effectiveness for Army aviation, combat vehicles, and parachuting. Develops health criteria for associated protective and life support systems. Conducts an active information transfer to health policy, combat and materiel developers, test and evaluation agencies, human factors agencies, and the aviation medicine community.

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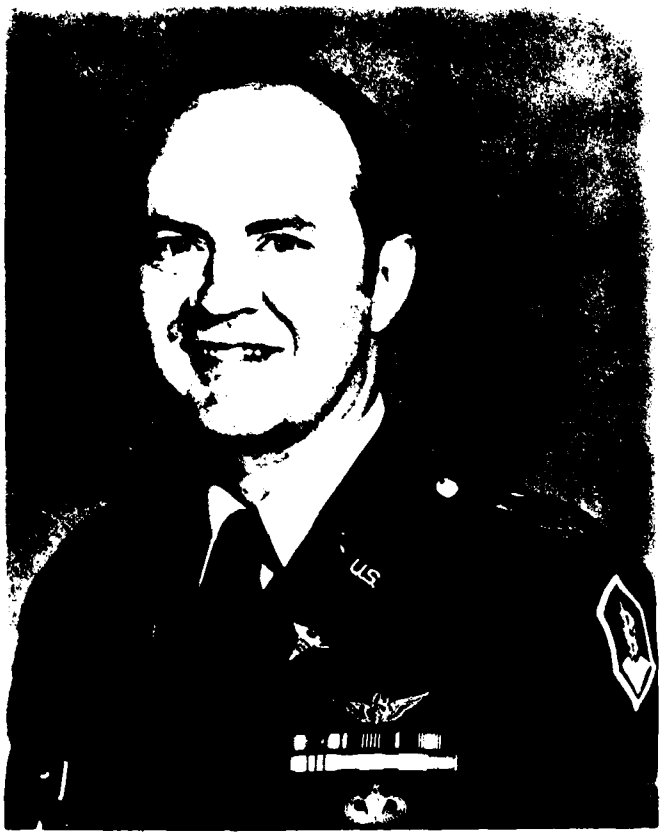


Col Stanley C. Knapp, Commander

LTC David D. Glick, Deputy Commander

Maj Roger P. Hula, Executive Officer

Introduction

The overall research effort of the U.S. Army Aeromedical Research Laboratory has two general objectives: enhancement of individual soldier and combat crew performance and efficiency, and prevention of injury or death in the military operational environment. These objectives are predicated on the assumption that the individual soldier is the most valuable resource to the Army; that future battles will be fought with high technology weapons in violent, sustained operations under all conditions; that the occupation of soldiering is inherently dangerous during war but should not be so during peace; and that apart from disease the most common cause of a soldier's acute and chronic incapacitation, injury, and death is caused by the technology of war and its weapon systems.

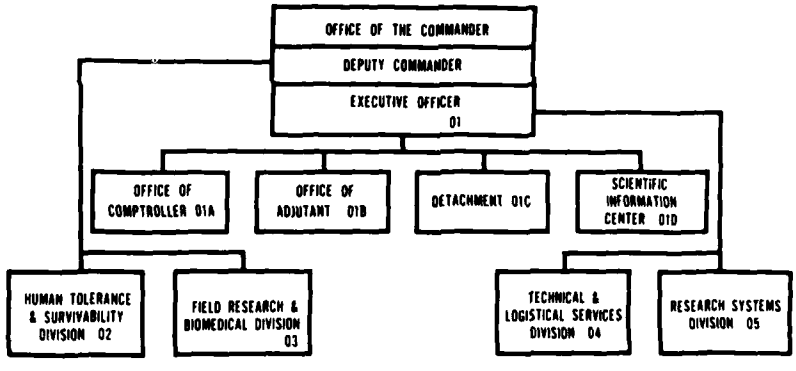
USAARL addresses these research objectives through identification, investigation and solving of medical and health related problems not only associated with aviation and airborne activities, but also to combat land vehicles and their crews and other combat weapons systems and environments as directed. Most of our research falls within the broad areas of physiological optics; the psychophysiologic aspects of combat crew workload and performance; bio-mechanics of closed, direct head trauma; the psychophysiology and physics of acoustics and communication; the clinical, orthopedic and biomechanical effects of long term vibration on the musculoskeletal system; and health hazard assessment of weapon systems, selected aviation doctrine, and operations.

USAARL's new mission statement approved in April 1979 reflects the continual alignment of USAARL capabilities with the Army Scientific and Technical Objectives Guide, Army requirements, and Medical Research and Development Command strategies and goals. It clearly identifies the Army soldier, operator, developer, designer, and tester as the primary user of the USAARL R&D product. Tasking USAARL to support the soldier during his training for and the actual execution of his combat duties by improving his tolerance and survivability to health hazards brings the laboratory's full preventive medicine potential to bear on the problems associated with war and its weapons through the 90's.

This report gives an overview of USAARL during FY 79, identifies current areas of research and gives a brief description of the research programs. The DA 1498's under which this research work is done are in Appendix A.

This report is prepared to fulfill the requirements of OTSG Regulation 70-31.

UNITED STATES ARMY AEROMEDICAL RESEARCH LABORATORY
ORGANIZATIONAL CHART



Management

The United States Army Medical Research and Development Command in 1978 instituted some insightful and important management changes that were destined to have far-reaching effects on command goals, laboratory objectives, and management techniques. Congressionally mandated programs influencing fiscal and equipment accountability as well as policies related to zero-based budgeting were felt at the bench researcher's level within laboratories.

To meet these challenges the first major reorganization of the laboratory began in February 1978. Reorganization into corporate, functional and scientifically multidisciplinary lines was completed in October 1978. A manpower survey in October 1978 with a new TDA and complete position analysis completed in June 1979 has channeled the laboratory's resources to more effectively execute the mission.

As new weapons systems, aircraft, armored vehicles, and individual equipment items have been introduced into the soldier's inventory, it has become evident that the USAARL research process is not only applicable but vital and essential to the solution of operational problems in other work environments besides aviation. This is reflected in the laboratory's involvement in the advanced combat vehicle programs, artillery systems, personal clothing and equipment, the DA life support and personal protective equipment programs, and many bi- and tri-military service technology and information exchange panels.

Navy and Air Force personnel are assigned to USAARL to work in areas considered vital to the Navy and Air Force but not being duplicated in their own laboratories.

Promulgation of standards of regulatory agencies for Army-unique situations is based on available information, often inadequate to support rational standards. Some health and engineering design standards with health implications have been fielded as DA policy, but without adequate or essential test criteria, instrumentation technology and methodology for assessment. Assessment technology in the area of effects on soldier performance is sorely lacking.

Current policies, criteria and standards for most of the insults to human tolerances do not exist, or are based on exposures expected in the industrial work place rather than in combat or combat training. Without a dedicated research effort to address Army-unique problems, data bases for equally unique standards will not be forthcoming, and the field fighting potential of future crew-operated weapons may not be realized because of unrealistic regulatory constraints on design or training, or both.

The laboratory reorganization has organized our research efforts into programs rather than individual projects. Participation in these programs crosses disciplines and requires the diverse contributions of each discipline. This approach enables us to acquire a data base from which to assess the health hazards. We are able to determine appropriate test criteria, instrumentation technology and methodology for assessment.

Health and performance effects relationships and analytical technologies are the principal products of this program approach. These products contribut to the assessment of risk, prevention to insult, and rapid diagnosis.

Personnel Strength

			Civilian			
77	Officer	EM	Perm.	Temp.	Co-op	Total
AUTHORIZED	29	38	55	0	0	122
ACTUAL	24*	35**	53	12	0	124
78						
AUTHORIZED	30	38	66	0	0	134
ACTUAL	29*	32**	55	5	1	129
79						
AUTHORIZED	30	46	65	0	0	142
ACTUAL	29*	40**	55	8	9	141

*Includes one Navy officer and one Signal Corps officer.
**Includes one Air Force sergeant.

Personnel Resources

USAARL has undertaken a vigorous and dynamic personnel program with elements that have far reaching impact on augmenting existing resources and planning for the future.

Establishment of an undergraduate cooperative education program, graduate fellow program, one-on-one scientific enlisted recruitment program for the laboratory's 21 specialty categories, and an aggressive initiative to recruit investigators have paid handsome dividends. An increase in enlisted strength, full utilization of co-op students, and temporary hires have helped satisfy USAARL's historically severely decremented personnel resources.

USAARL continued its support of upgrading the skills of assigned personnel by having 42 persons receive training and professional development during FY 79. In addition, twenty persons attended classes in off-duty hours to further their career goals and upgrade job skills. In FY 79 two enlisted persons completed requirements for their bachelor degree through off-duty study.

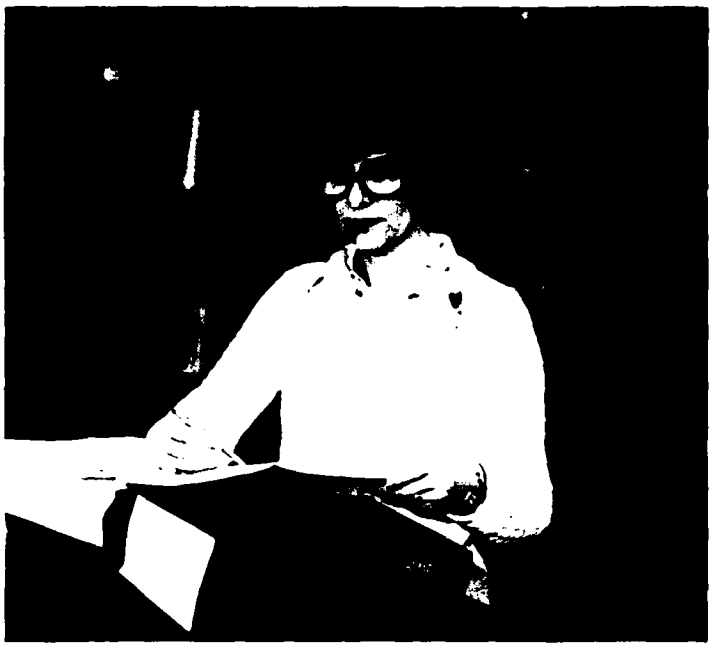
Six military personnel are enrolled in Command and General Staff College non-resident programs.

This past fiscal year USAARL provided an opportunity for interested personnel to increase their job skills and earn college credit through a lunch period course in medical terminology. This course was taught at USAARL and 21 persons attended; 8 were from the laboratory. The lunch period course was a pioneer effort at Fort Rucker and led to lunch period courses being offered postwide. Two members of the laboratory are continuing their education through those courses.

Contributions to the academic community are made by five laboratory personnel who hold adjunct or temporary teaching positions at four colleges and universities within the area.

Among the laboratory's personnel there are 20 doctorate, 23 master, and 23 bachelor degrees.

During FY 79, 8 of the 20 first term personnel assigned to USAARL have reenlisted or extended their tours of duty for a total of 11 years 4 months. There were 4 years 10 months and 56 days of extensions or reenlistments for career personnel.



Co-op Program

A bold venture to establish an undergraduate cooperative education program and a graduate fellow program began in early FY 78. Recruitment efforts have succeeded. The first student arrived at USAARL in December 1978.

The objective of establishing this program was to assist the universities in developing students with practical as well as academic knowledge in their major field of interest--which makes the student more valuable to a potential employer; to furnish primary investigators with able research assistants; and to assure that there are especially trained personnel available to fill entry-level career positions in the field of Army aero-medical research.

We work with 16 universities to recruit students and to assure a satisfactory working relationship for both the student and the laboratory. During FY 79 we had a total of 17 undergraduates and 3 postgraduate fellows contributing 8.08 man-years of time to the laboratory's research efforts.

Intern Program

The laboratory has one optical physicist intern position. The position was filled through competitive placement at the GS-07 level in FY 79. A training program was developed which specified both outside formal training and on-the-job training. By assisting with projects going on under the vision program, the intern will meet the on-the-job requirements and be providing productive work to the research effort

Federal Women's Program

USAARL supports the Federal Women's Program (FWP) by appointing a laboratory FWP manager. The USAARL FWPM acts as the laboratory representative to the Fort Rucker Federal Women's Program Committee.

In addition, the USAARL librarian, Ms. Sybil Bullock, serves as Fort Rucker's Federal Women's Program Manager. Ms. Bullock was elected in October 1978 by the FWP Committee to fill the post of Fort Rucker FWPM for two years. This is the first time a member of any of the twenty tenant activities has been chosen for this position. Twenty percent of Ms. Bullock's time is allocated to this duty.

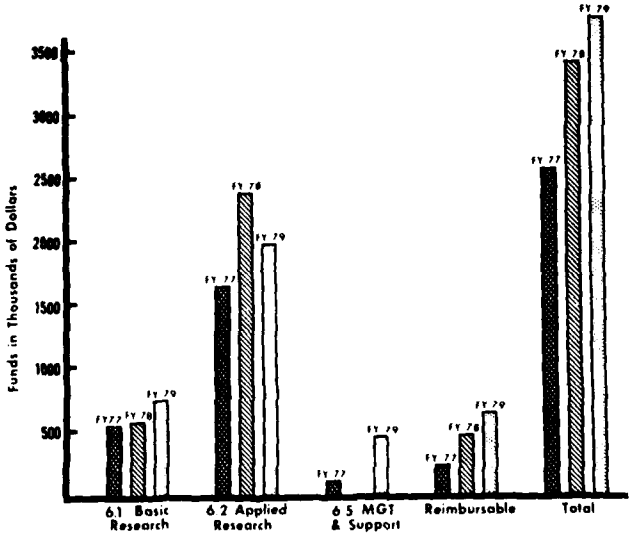
Personnel Achievements

	No. Presented
Civilian Awards	
Outstanding Performance	30
Quality Step Increase	9
Sustained Superior Performance	3
Letters of Commendation	20
Military Awards	
Meritorious Service Medal	5
Army Commendation Medal	5
DA Certificate of Achievement	2
Letters of Commendation	20
Promotions	
Officer	3
Enlisted	21
Civilian	1

Special Recognition

Major Lawrence R. Whitehurst	Diplomate, American Board of Family Practice
SP5 Pamela M. DiGennaro	USAARL Soldier of the Year
Mr. John H. Hapgood	Patent

Funding



FUNDING FY 77–78–79

Contracts

Title: Spatial Resolution Thresholds During the Course of Dark Adaptation

CONTRACT NO: C-7007-0C-7888
CONTRACTOR: Texas Tech University School of Medicine, Lubbock, Texas
INVESTIGATOR: Perry Speros

Objective: The objective is to determine the visual capability of aircrew at different times during recovery from image intensifier adaptation.

Title: Night Vision Performance in Detection and Identification of Moving Targets After Glare

CONTRACT NO: C-7055-0D-7887
CONTRACTOR: Optical Sciences Group, Inc., Visual Science Division, 24 Tiburon Street, San Rafael, California
INVESTIGATOR: A. J. James

Objective: This research is needed to identify vision environments which can be expected to maximize or minimize personnel performance at night in continuous military operations. It is vital to know the degree of impairment of detection produced in aircraft and equipment operators exposed to environmentally relevant levels of photostress.

Title: Inner Ear Histology Techniques

CONTRACT NO: Q-7456-0D-7888
CONTRACTOR: Bio-Acoustics Laboratory, Syracuse University, Syracuse, New York
INVESTIGATOR: Roger P. Hamernik

Objective: The object of this research is to evaluate the inner ears of 16 chinchillas for loss of sensory cells after chronic exposure (in-house) to continuous noise.

Title: Auditory and Non-auditory Effects of Exposure to Low Frequency Noise

CONTRACT NO: Q-9017-0D-7891
CONTRACTOR: Department of Otolaryngology, Medical University of South Carolina, 171 Ashley Avenue, Charleston, South Carolina
INVESTIGATOR: John H. Mills

Objective: The hearing threshold shift information derived from this study will provide data on humans that will be obtained on animal models exposed to the same bands of low-frequency noise. This will enable validation of the animal model data pertaining to the effects on hearing of exposure to the types of noise to which aromor crewmen are exposed. Similar bands of noise are produced at comparable intensity levels by the current generation of armored vehicles (e.g., MICV).

Title: Cochlear Microphonic Response to Low Frequency Noise

CONTRACT NO: C-8067-0C-7886
CONTRACTOR: University of Florida, Gainesville, Florida
INVESTIGATOR: Donald Teas

Objective: Many military vehicles, particularly those found in armor, produce high intensity noise which is predominatly low frequency. The objective of this study is to explore the mechanism of noise induced hearing loss exposure to high intensity, low frequency noise.

Title: Simula II

CONTRACT NO: DABT01-79-C-2050-1
CONTRACTOR: Simula Inc., 2223 S. 48th Street, Tempe, Arizona
INVESTIGATOR: Stanley P. Desjardins

Objective: Phase II in the requirement to develop crashworthy earcups for the SPH-4 Army aircrewman helmet.

Title: Effects of Visibility

CONTRACT NO: DABT01-79-C-0312-1
CONTRACTOR: Institute of Medical Sciences, Smith-Kettlewell Institute of Visual Sciences, 2200 Webster St., San Francisco, California
INVESTIGATOR: Anthony Adams
Gunilla Haegerstrom-Portnoy

Objective: Investigate spatial, temporal and retinal eccentricity effects on visibility in the dark-adapted eye.

Title: Material Characteristics

CONTRACT NO: DABT01-79-C-0045-1
CONTRACTOR: Auburn University, Auburn, Alabama
INVESTIGATOR: Dr. Warton Jemian

Objective: Research into the optimum characteristics of materials for head protection during impact.

Title: Multiaxis Impact Experiment on Volunteers

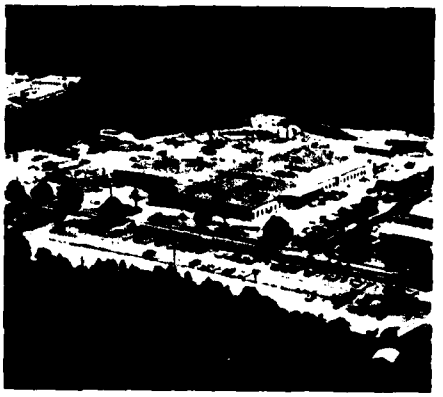
CONTRACT NO:	ARL-MIPR-2-79 (DD 448)
CONTRACTOR:	USN Aerospace Medical Research Laboratory (Mischoud Station), Pensacola, Florida
INVESTIGATOR:	Dr. Channing Ewing

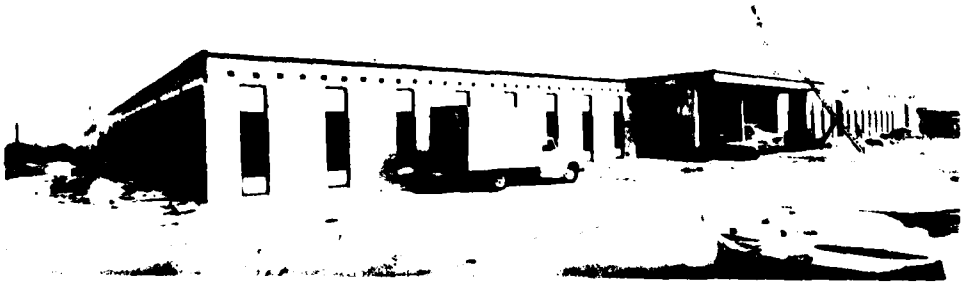
Objective: This Tri-Service project was undertaken to measure kinematic response of critical anatomical parts of volunteers undergoing impact.

Title: Mechanisms of Human Injury

CONTRACT NO:	ARL-11-79 (DA 2544)
CONTRACTOR:	Applied Technology Laboratory, USA Research and Technology Laboratory, Ft. Eustis, Virginia
INVESTIGATOR:	Dr. Albert King and George Singley, III

Objective: This work is done in support of the Tri-Service human tolerance investigation. The objective is to determine the mechanisms of human injury when deceleration occurs in a crash-worthy crew seat. This subcontract is part of a Tri-Service supported contract, Human Body Ejection Seat Dynamics, being conducted at Wayne State University School of Medicine. Executive agent for the Wayne State study is the USAF Aerospace Medical Laboratory, Wright Patterson AFB, Ohio.





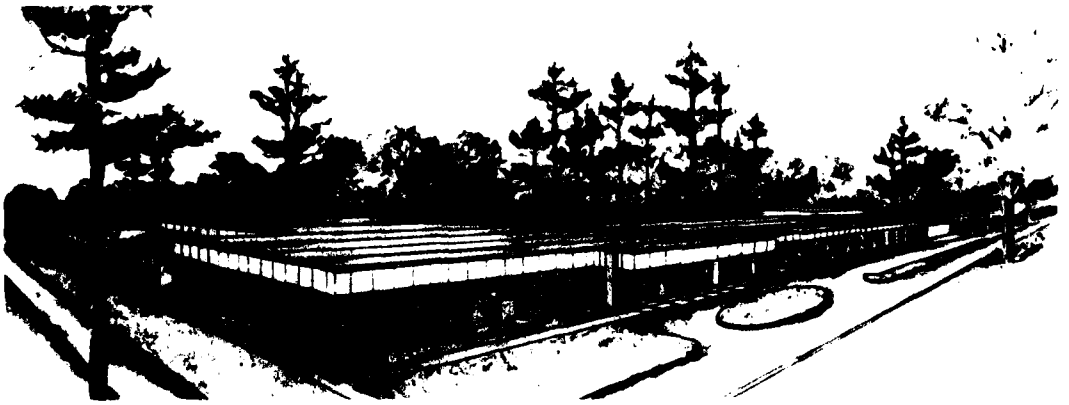
USAARL's New Facility

Progress

Date Of Contract	28 April 1978
Ground Breaking	2 May 1978
Construction Began	12 May 1978
Size	116,620 sq. ft.
Cost	$7.5 million (final estimate)
Estimated Completion	September 1980
Number of Construction Personnel on Site	85 (average)

Laboratory Features

Anechoic Chamber
Animal Surgery
Biochemistry Laboratory
Biomedical Maintenance Shop
Drop Tower
Electronics Shop
Flight Simulators
Hybrid Computer Center
Machine & Fabrication Shop
Optics Laboratory
Photography & Graphic Arts
Scientific Information Center
Sound Rooms
Vibration Laboratory
Vivarium



Scientific Programs

The effective management of a scientific research laboratory with a broad mission and limited resources requires continuous evaluation. New thrusts are constantly under consideration by the laboratory and are based on input from the mission area manager, interservice discussion, international meetings, and threat intelligence. In FY 79 the work units were divided into eight scientific programs which facilitate local management and demonstrate current thrusts to others interested in our work. The programs are scientifically multidisciplinary and managerially cross functional organizational boundaries.

The three DA 1498's terminated during FY 79 were:

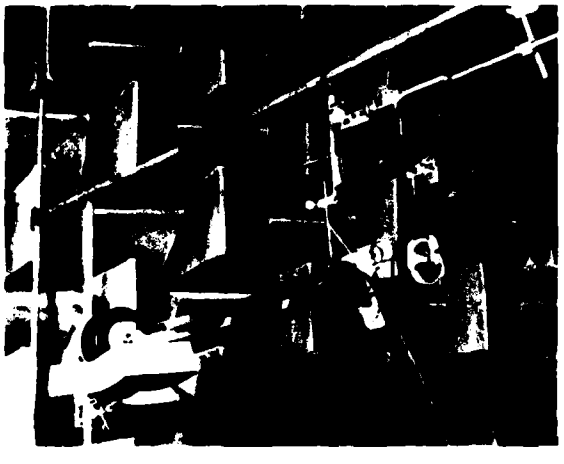
Biomedical Research in Support of Advancing Military Operations, program element 6.27.73.A, project number 3E162773A819, work unit 011.

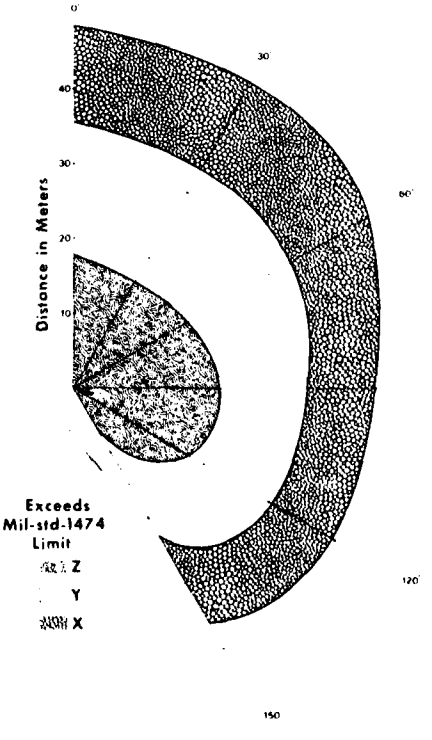
Evaluative and Consultative Biomedical and Ergonomic Support to Systems Development Programs, program element 6.27.73.A, project number 3E162773A819, work unit 012.

Retinal and Extra-Retinal Factors in Visual Acquisition, program element 6.11.01.A, project number 3A161101A91C, work unit 293.

*Begun in FY 79 was work under DA 1498, Combat Vehicle Crewman (CVC) Helmet--Impact and Acoustical Evaluation, program element 6.37.45.A, project number 1L263747D669-32-004, work unit 051.

*Asterisks denote contract or reimbursable projects and as such are not reported on DA Form 1498 through DTIC Data Bank. USAARL uses the DA Form 1498 for internal control and information; therefore these DA Form 1498's are included in Appendix A but without the DA Accession Number.



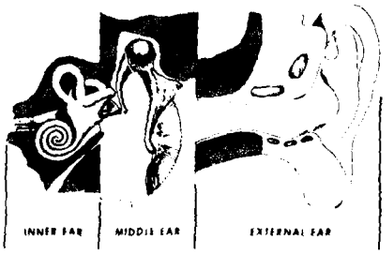

Distance in Meters
Exceeds
Mil-std-1474
Limit
Z
Y
X

Acoustics Program

Background: The development of propellant charges enabling greater ranges for conventional artillery systems create impulse noise levels far in excess of any previously encountered or studied. Information available in high-intensity impulse noise is very minimal. Civilian agencies are not involved in high-level impulse noise research because it is a uniquely military problem due to levels and spectral characteristics of impulses. Armor vehicle technology has led to lightweight, high speed combat vehicle which generate high-intensity, low-frequency noise in crew areas. The high-intensity, low-frequency noise interferes with communications and may exceed the capabilities of hearing protective devices to provide the needed levels of attenuation. The loss of this capability results in crew exposure to potentially hazardous intensity levels of low-frequency noise. High-intensity, low-frequency noise has been recognized by USAARL as a potential hazard. High speed operational requirements result in crew vibration which may synergistically interact with low-frequency noise and impulse noise producing greater hazards to hearing.

Objective: The acoustic program objectives are to: (1) determine the health hazards of the acoustic environment of new generation weapon systems such as M-198, M-109, X-M1, X-M2, X-M3, and HSTV(L); (2) determine biomedical tolerance limits for combat crew to impulse noise, steady-state low-frequency noise, vibration, and synergistic combinations of these; and (3) develop risk-criteria for crew protection, criteria for improved hearing protective devices without communication impairment or acoustic hazard, and assessment technology.

DH-178



Achievements: USAARL has established that low-frequency noise induces a high-frequency hearing loss. The noise levels around new generation artillery weapons have been quantified. A basic research program on impulse noise has been initiated. New microphones and radio systems were evaluated; and feasibility studies of physical ear attenuation testing were conducted.

Projects: Research efforts continue to accumulate data with which to validate or modify existing damage risk criteria for steady state low frequency noise and steady state low frequency noise in combination with vibration and impulse noise. Work will continue on developing methodology for the efficient and rapid assessment of effective exposure levels for new hearing protective devices. Basic research programs to develop a new Damage Risk Criterion (DRC) for impulse noise are being developed.

DD 1498s: The DD 1498s under which the work for this program is carried on are: (See p. 56-59.)

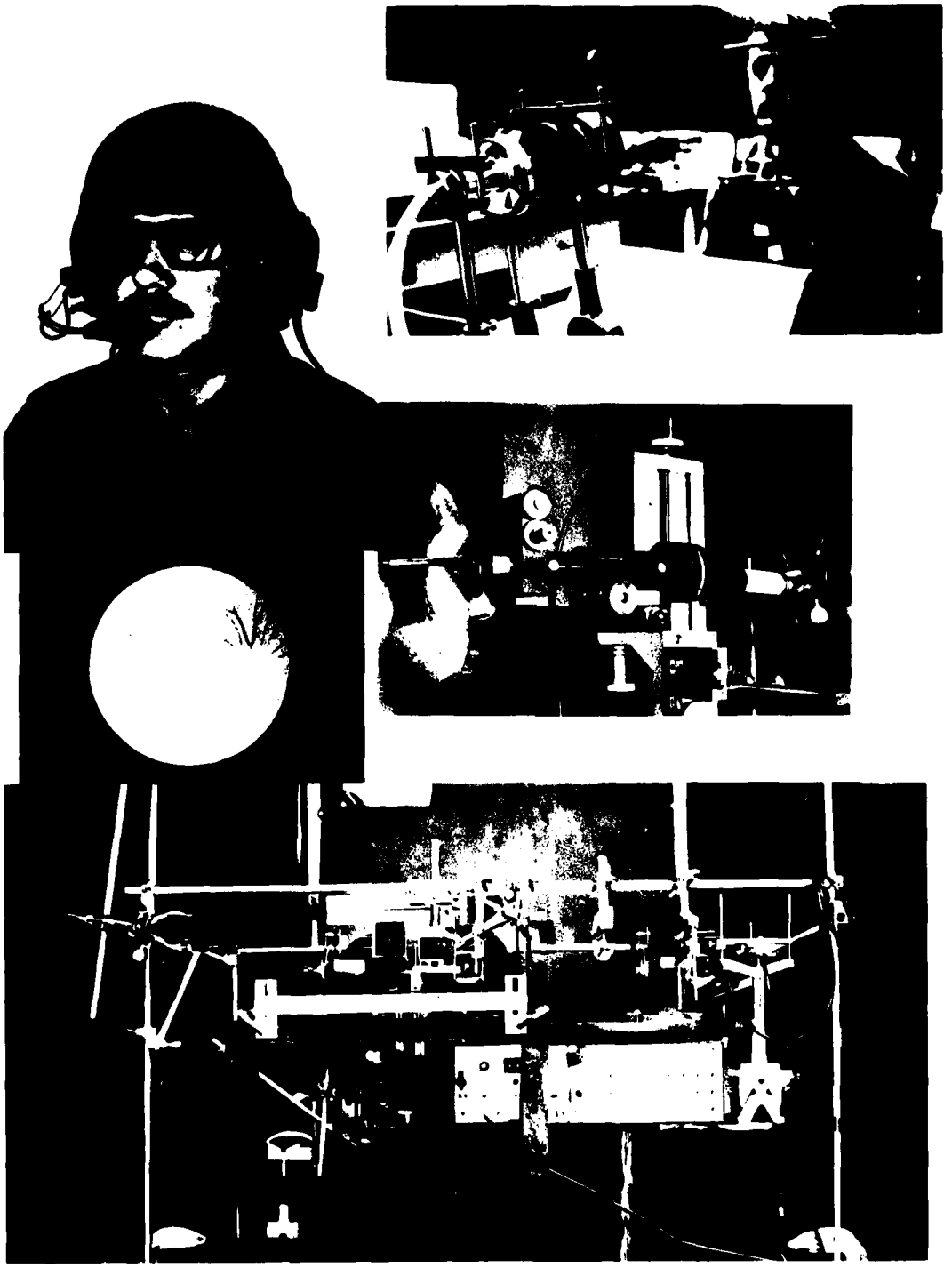
Military Acoustic Hazards; Mechanisms of Hearing Loss; program element 6.11.02.A, project number 3E161102BS07, work unit number 026.

Medical Assessment of Hearing Protective Devices; program element 6.27.73.A, project number 3E162773A819, work unit number 050; and program element 6.11.02.A, project number 3E161102BS07, work unit number 023.

*Combat Vehicle Crewman (CVC) Helmet--Impact and Acoustical Evaluation; program element 6.37.47.A, project number 1L263747D069-52-004, work unit number 051.

*Medical Effects of Blast Overpressure; program element 6.27.73A, project numbers 3E162773A819 and 3E62773A818, work unit number 041.

* (See page 21.)



Visual Physiology and Psychophysics Program

Background: The human visual system is one of the primary means by which information is acquired in the military operational environment. An efficient transfer of information to the human visual system of the equipment operator is vital in a mechanized society. Information concerning the capabilities and limitations of the human visual system and the impact on visual performance of military operations, environment, and equipment is required to ensure that information is efficiently transferred.

Objective: The visual physiology and psychophysics program goals are to: (1) develop a data base of luminance, contrast, and motion parameters affecting human spatial visual capability in order to optimize compatibility between the visual system and military information display systems; (2) evaluate different types of transparencies with respect to their physical standards and their effect upon operator performance so as to establish a data base which will eventually lead to more efficient ways of specifying the visual quality of transparencies; (3) evaluate the incompatibility of refractive error correction by spectacles with visual displays, protective helmets, and protective masks; (4) develop a neurophysiological data base to advise the military on the visual impact of operational environments; and (5) determine if red light or white light is superior at the low luminance levels required in the cockpits of Army aircraft.

Achievements: Dynamic vision measurements were established as a valid tool in the study of pilot fatigue. A fast transient response to flashing lights was defined and quantified. Through contrast transfer functions, the best phosphor to be used in a helmet mounted display was visually defined. Development of

biotechnology for night vision goggle (NVG) daytime training filters for the night vision goggles has materially assisted in student training in the use of NVGs. The optical and visual evaluation of a protective mask (XM-29) CBR determined inadequacies that made it unsuitable for Army aviation use. Design technology for combat spectacles has increased spectacle compatibility with some military equipment, produced a more adequate field spectacle, and assures better eye protection.

Projects: A series of studies to quantify the interactions of electro-optical display parameters and the human visual system are being conducted to obtain meaningful and realistic user display performance measures. In concert with other groups, we are working to develop relevant electro-optical display image assessment techniques. Work is in progress to measure and specify both the temporal and spatial characteristics of imaging information systems. A study of spatio-temporal factors in dark adaptation and a study of luminance, contrast and motion factors in visual resolution are in progress.

DD 1498s: The DD 1498s under which the work for this program is carried on are: (See p. 60-62.)

Research of Electro-Optical Systems and the Human Visual System; program element 6.27.73A, project number 3E162773A819, work unit number 003.

Visual and Optical Evaluation of Nonmedical Material program element 6.27.73.A, project number 3E762773A819, work unit number 004.

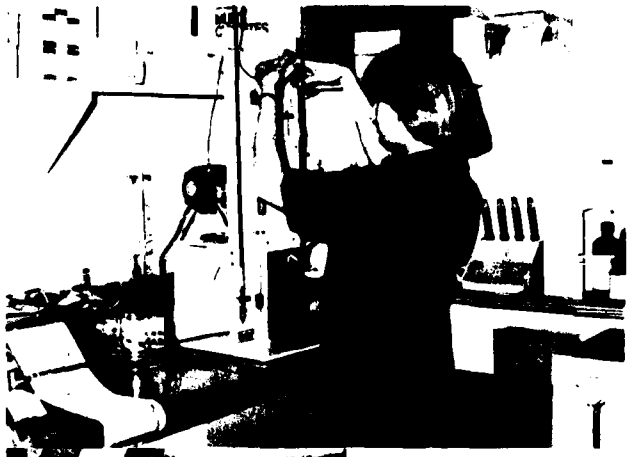
Research of Visual Problems Medically Significant to the Army; program element 6.11.02.A, project number 3E161102BS07, work unit number 028, and program element 6.27.73.A, project number 3E162773A819, work unit number 002.

Sustained Aviation Operations, Crew Workload, and Stress Program

Background: The Army requirement for around-the-clock performance capability requires that commanders have the capability to make objective judgments regarding levels of aircrew fatigue during sustained operations. Army aviators are training to fly helicopters at or below treetop levels day and night to avoid enemy anti-aircraft threats. These are relatively new and extremely stressful tactics. There is a recurring interest in self-deployability of aviation assets from CONUS overseas to combat zones. Such long and dangerous flights raise many unanswered aeromedical questions. Night vision sensors and target acquisition systems have been developed to extend man's visual capabilities far out into the night. Millions of dollars are programmed for developmental and procurement systems whose complex design may overtax pilot workload, stress, fatigue and safety levels. Aeromedical data is required to define psychological and physiological capabilities and limits of soldier tolerance to operational stressors, military hardware, advanced tactics, and progressive military operations.

Objective: Objectives of the program include research on the topics of (1) aviation crew fatigue and work/rest schedules in sustained operations, (2) aeromedical aspects of self-deployability of aviation equipment and crews to combat zones overseas, (3) operational stress, safety and performance in helicopter terrain flight in both day and night operations, and (4) psychomotor, oculomotor and psychophysiological assessment of pilot workload and stress associated with the use of advanced military hardware systems (e.g., night vision goggles (NVG), pilot night vision systems (PNVS), target acquisition designation systems (TADS), and the integrated helmet and display sighting system (IHADSS)) being developed for the Army Advanced Attack Helicopter.

Achievements: In August 1979, USAARL personnel participated in the self-deployment of helicopters to Europe without aerial refueling. A flight surgeon-researcher accompanied the crews on the mission, while a psychologist-data collector worked with the crews at intermediate stops along the route.



Biomedical limits and human performance data, models, etc., have been input directly into developmental designs on hardware systems. This is especially true for night vision goggles and for sensor, sighting, tracking and display systems being developed for the Advanced Attack Helicopter.

Since 1972 USAARL has been conducting an ongoing series of in-flight and flight simulator experiments and research projects designed to measure psychomotor, physiological, oculomotor and communicative pilot workloads associated with day/night low altitude flight.

USAARL paved the way in instrumentation and methodology for the study of complex aviation missions. Research efforts successfully demonstrated inflight that the integration of digital information into night vision goggles can significantly reduce pilot workload and stress for nap-of-the-earth flight.

Projects: Reduction and analysis of data from field research into extended helicopter operations is being completed. A second experiment into extended helicopter operations, being performed in a helicopter simulator, is underway. Now under review are the experiences and data collected during participation in the self-deployment of helicopters to Europe. Beginning is a quantitative study of copilot workload in navigating at nap-of-the-earth flight levels with doppler navigation system and projected map display in support of PM AAH. Work continues into the psychomotor, oculomotor, and psychophysiological assessment of aviator visual workload.

DD 1498s: The DD 1498s under which the work for this program is carried on are: (See p. 63-67.)

Research Directed at Biomedical Parameters Affecting Aircrew Workload During Sustained Operations; program element 6.27.73.A, project number 3L162773A819, work unit number 001.

Visual Performance Research Related to Operational Problems in Army Aviation; program element 6.27.73.A, project number 3L162773A819, work unit number 010.

Aeromedical Research of Operationally Significant Problems in the Army Aviation Environment; program element 6.27.73.A, project number 3L162773A819, work unit number 020.

*Development of Measurement Techniques for the Medical Assessment of Visually Coupled System (VCS) Components; program element 6.42.07.A, project number 4E464207D425, work unit number 048, and program element 6.11.01.A, project number 3A161101A91C, work unit number 288.

*Aviator Workload/Performance Assessment in Support of the Advanced Attack Helicopter; program element 6.42.07.A, project number 4E464207D425, work unit number 049.

*(See page 21.)

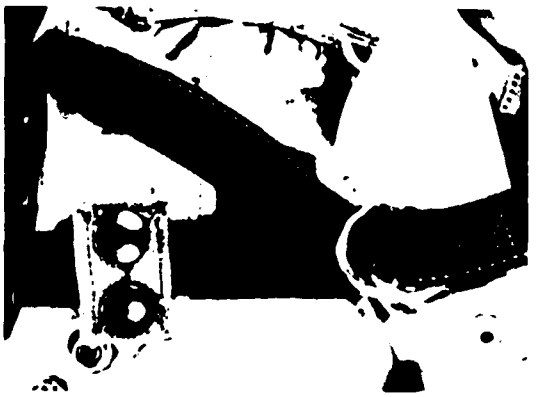
Impact Physiology in Support of Crashworthiness and Personal Armor Development Program

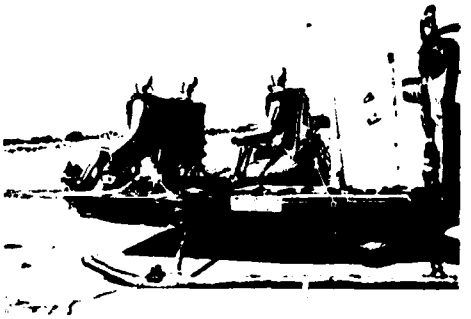
Background: Because they lacked adequate impact protection, 439 Army flyers died and 2,663 were injured in potentially survivable aircraft accidents. These deaths and injuries occurred within a 2 year period, 1967-1969. This equated to an approximately 25 million dollars loss annually in personnel replacement costs. Today's injury studies indicate that approximately one of three fatalities is due to head and/or neck injury. Skull fracture tolerance is known fairly well on the basis of cadaver and animal research; but research on the mechanisms of head injury (including concussion) in crown impacts, parietotemporal impacts, and facial impacts is still needed.

Faster ground and flight vehicles create a more severe impact environment for the future. Whole body tolerance to forward and vertical impact force was established grossly in the 1950s; however, the tolerance to impacts from other directions is still largely unknown. The military community has expressed a need to know the tolerance of the body to combined downward, forward, and sideward impacts.

Personal body armor capable of defeating 10-15 mm armor-piercing projectiles in the 2500-3000 ft/sec range is available, but the rear surface signature effect of such armor on various areas of the body is largely unknown. Research to determine the potential for injury of such armor is needed.

Objective: The effects of impact on the protected soldier when he is exposed to projectiles, accidents, and during normal operations are not fully known. The impact physiology program goals are to: (1) develop multi-axis unconsciousness threshold criteria due to helmeted head impact; (2) develop skull and/or cervical spine fracture limits for crown and temporal helmeted head impacts; (3) develop facial fracture limits to impact when protected by night vision goggles, face shields, oxygen masks, etc.; (4) develop seated whole body (inertial) impact tolerance to Z-axis loading combined with X- and Y-axis loading; (5) develop seated whole body (inertial) impact tolerance to Y-axis (side) loading; and (6) develop the limits of pressure and time on the torso due to rear surface signature(s) of body armor struck by projectiles.



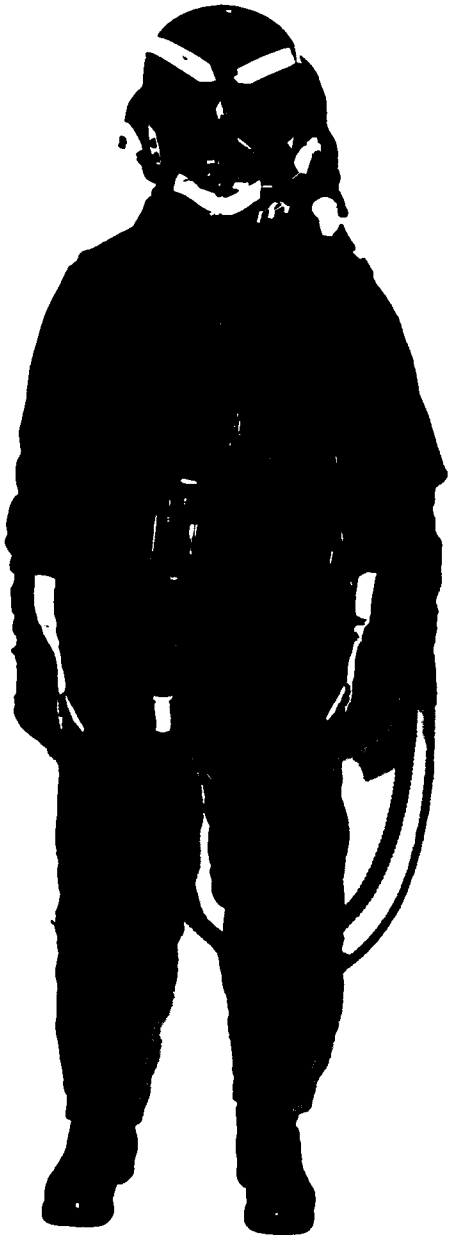


Achievements: A crashworthy troop seat concept for the Blackhawk was developed that incorporated human tolerance and orthopedic design criteria. Most of these concepts were incorporated into the present Blackhawk seat. Bioengineering criteria for a stronger SPH-4 chin strap was developed and given to the helmet developers. Bioengineering criteria for a "crushable" earcup are being developed. SPH-4 helmet test and future flight helmet bioengineering design and test criteria are now being written. Bioengineering design criteria for the Integrated Helmet and Display Sight Systems (IHADSS) was provided to the Advanced Attack Helicopter (AAH) program manager in the planning stages. Analysis of impact damaged equipment through laboratory duplication of the impact force to the equipment was begun under this program. The procurement of substandard material was prevented through material evaluation.

Projects: A protective uniform for combat vehicle crewmen currently being developed by NARADCOM will include a new helmet. NARADCOM will formulate the design requirements and criteria; however, USAARL will determine the levels of acoustic and impact protection required. Additionally, a test method will be developed to validate the helmet's performance. There will be three types of research into body tolerance of impact force: whole body impact, impact to head and neck, and impact effects of defeated projectiles.

DD 1498s: The DD 1498 under which the work for this program is carried on is: (See p. 68).

Research of Bioengineering Problems Medically Significant To Army Aviation; program element 6.27.73.A, project number 3E162773A819, work unit number 015.



Health Hazard Assessment Program

Background: Health hazard assessment of the aviation and combat crewmember environment has been in existence for some time. However, the operational problems, techniques, and thrust areas continuously change. Recent changes in operational doctrine and tactics coupled with more sophisticated and complex equipment have placed additional stress on combat vehicle crewmembers. Missions require flight at low level and nap-of-the-earth, during adverse weather conditions, around the clock, day and night, and often at increased altitude and atmospheric elevations. Threat nations are capable of and are expected to use nuclear, biological and chemical weapons. Man's ability to effectively perform and survive under these additional stressors is limited and must be augmented. Aviators involved in aircraft accidents experience an unacceptable number of major and fatal injuries. The loss of experienced aviators is costly and reduces combat effectiveness. The health hazard assessment program is necessary to identify, evaluate, and eliminate the health hazards imposed by today's combat environment.

Objective: The health hazard assessment program is planned to (1) enhance the aviation and ground combat vehicle crewmember's ability to survive and operate effectively through assessment and alleviation of health hazards and physiological stress imposed by the operational environment; (2) develop biomedical and physiological instrumentation and measurement techniques to allow assessment of the health hazards associated with stresses of noise, visual restrictions, thermal environments, altitude, atmospheric conditions, and the biophysics and biomechanics involved in vehicle emergency operations; (3) apply these measurement techniques to evaluate effectiveness of the life support protective equipment and systems; and (4) determine medical health requirements for establishment of operational regulations, standards and design criteria.

Achievements: USAARL was instrumental in replacing the APH-5 helmet with the much improved SPH-4, and today we are revising the SPH-4 specifications based on data extracted from the crash injury epidemiology program. USAARL conducted health hazard assessment studies of the UTTAS, the XM-29 mask, and the personnel armor system for ground troops (PASGT) helmet. Consultations on improvements in life support equipment are conducted with the user community on a continuous basis.

Projects: Biomedical evaluation of health hazards and injury mechanisms involved in Army aviation accidents and studies of impact/injury will be continued. The biomedical effectiveness of the present protective nuclear, biological and chemical systems is being evaluated. Studies in the biomedical aspects of enriched oxygen generation systems and their effectiveness in the elimination of immediate operational health hazards continue. Assessment and validation of the effectiveness of design criteria for the next generation of ground combat vehicle crewmen life support protective equipment in order to establish noise and impact criteria to protect against such health hazards are underway. Toxicological assessment of combat vehicle and combat weapons environments will continue in an effort to reduce overall health hazards.

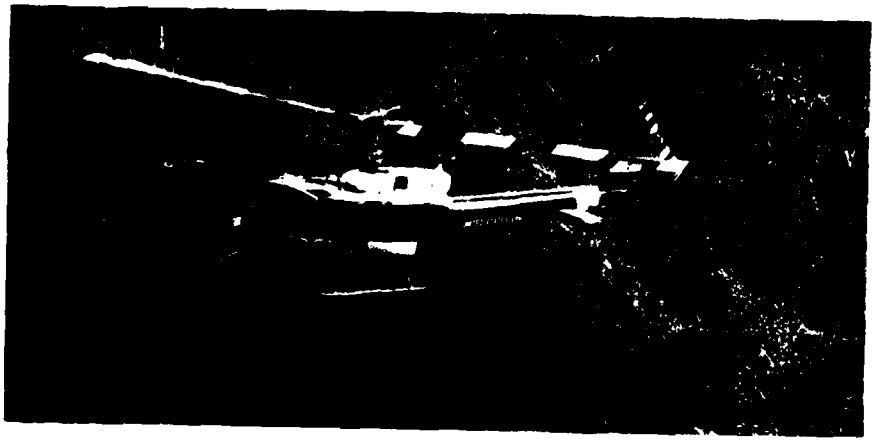
DD 1498s: The DD 1498s under which the work for this program is carried on are: (See p. 69-72.)

Direct Field Support to Immediate Army Aeromedical and Ground Vehicle Problems; program element 6.27.73.A, project number 3E162773A819, work unit number 005.

Life Support Equipment Retrieval Program; program element 6.27.73.A, project number 3E162773A819, work unit number 013.

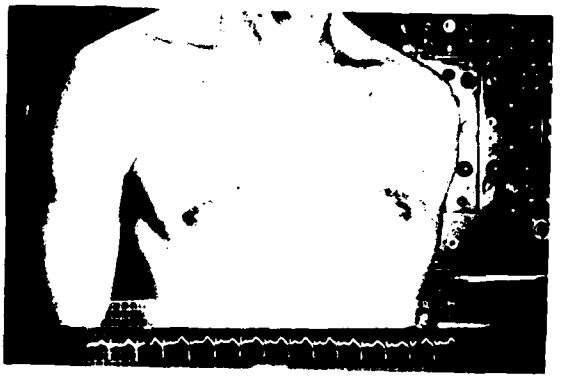
Research Countermeasures for Significant Medical Hazards in Military Systems; program element 6.27.73.A, project number 3E162773A819, work unit number 014.

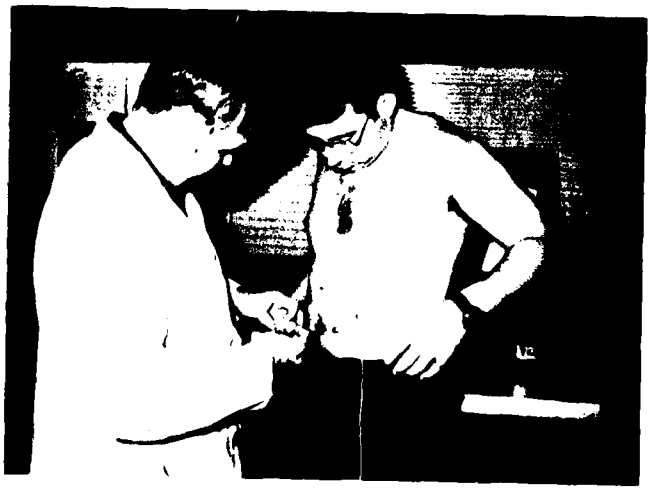
Biomedical Application and Health Hazard Assessment of Oxygen Enrichment Breathing Systems; program element 6.27.73.A, project number 3E162773A819, work unit number 047.



MEDICAL SERVICE

STANDARDS OF
MEDICAL FITNESS

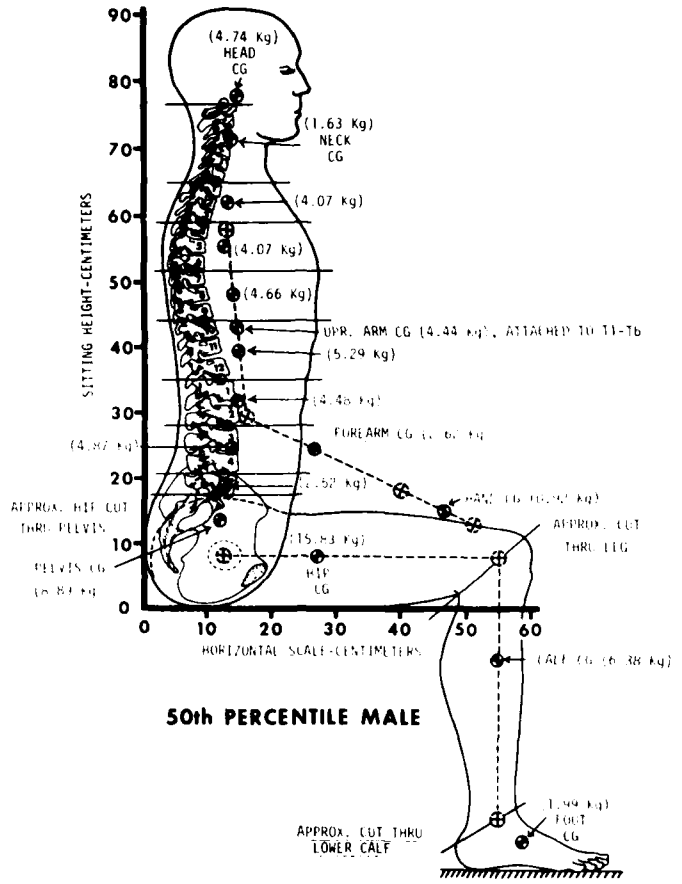




Medical Aspects of Crew Selection Program

Background: USAARL has been intimately involved with both the developmental changes and the applications of physical standards--particularly for Army aviators--for many years. Numerous research projects have been conducted to provide a data base leading to possible modification or clarification of existing regulations. In response to requests from outside agencies (the Army Aeromedical Activity in particular) personnel of this laboratory have conducted consultations involving the application of physical standards. These consultations included vision, cardiovascular, auditory, pulmonary, psychological, anthropometric and vestibular problems. Although these consultations were performed informally, a formal request for assistance was received by the Office of The Surgeon General in September 1977 from the Vice Chief of Staff, DA, through BG C. Canedy, Acting Director of Requirements and Army Aviation Officer, and BG R. Sweet, Deputy Director of Military Personnel Management. The purpose of their request was to determine the minimum, definable, measurable requirements that must be possessed by an applicant to pilot and employ Army aircraft. Coordinated by the Army Research Institute at Fort Rucker, this effort was planned with the Assistance of USAARL personnel as directed by AMRDC. The research plan, consisting of methods, required funding, and manpower, was presented to appropriate DA staff. USAARL continues to work on certain aspects of this problem area.

Objective: The objective of this program is to determine biomedical criteria for selection, retention and physical standards for military personnel which are relevant to the operational requirements of the Army's mission. Specific goals are to: (1) determine validity of selected visual standards as applied to Army aviators and other aircrew personnel in the operational environment; (2) analyze the anthropometric differences of the male and female performance in the aviation environment; (3) better define the relationship and necessity for standard audiometric testing and auditory perception of voice communication; and (4) develop psychomotor/psychological tests applicable to crew selection and retention.



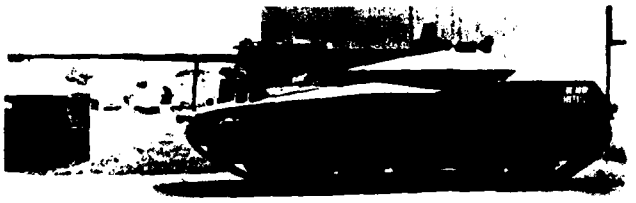
50th PERCENTILE MALE

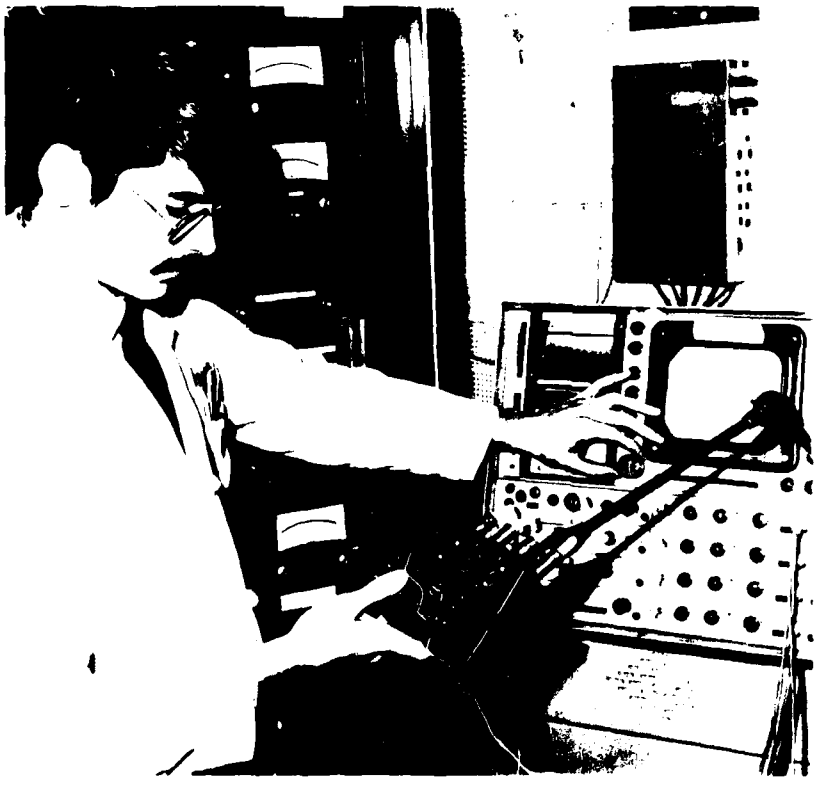
Achievements Research concerning crew selection and retention and physical standards has been done under various 1498's in the past. The study of the role of vibration on long term pathology of the bony end joints, vision consultations, and studies on monocular vision in aviators are examples or work done under associated 1498's that apply to this program. This is a new program that will focus these various segments of work toward the overall problem of physical requirements for crew selection and retention.

Projects: A critical review of current vision standards so data will be available to update standards is in progress. A contract research effort is in progress to assemble sufficient clinical data so current heterophoria standards can be validated. A protocol will be written concerning the after-effects of high brightness levels to dark adaptation.

DD 1498s: The DD 1498 under which the work for this program is carried on is: (See p. 73.)

Aviation Medicine Research for Aircrew Selection, Retention, and Physical Performance Standards; program element 6.27.73.A, project number 3E162773A819, work unit number 007.





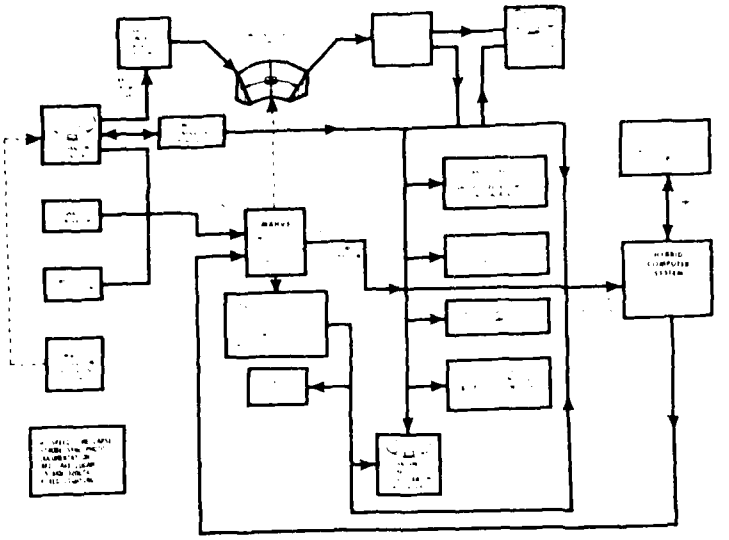
Biomedical Aspects of Vibration Program

Background: Changes in doctrine and advances in equipment technology have modified the role of vibration from that of a nuisance to that of a real operational hazard. Low mass advanced tracked vehicles operating at higher speeds expose restrained crews in unusual seating positions to direct coupled vibration. The resultant effects on the visual, auditory, vestibular and neuromuscular function are not fully known inasmuch as the exposure factors are unique to emerging military weapon systems. A crewman must now operate in a severe vibration environment, experience prolonged continuous exposure, and still perform with greater accuracy, efficiency, and dexterity than ever before.

The vibration program was initiated in response to a need for preventing vibration related musculoskeletal disorders in Army aviators. Since then its scope has been expanded to include the prevention of all vibration related disease and human ineffectiveness caused by Army materiel. The requirements for this mission are established in AR 10-5, para 2-35-a7, and AR 602-1, para 5C, as well as in the DOD Scientific and Technical Objectives and Goals Document.

Objective: Vibration affects the body in two hazard areas: health and effectiveness. The general goals of the vibration program are to define these effects and determine a means to alleviate detrimental influences of vibration exposure. Specific goals are to: (1) define the effect of vibration on the neuromuscular control system; (2) determine the role of vibration in producing trauma in joints and bone; (3) determine the effect of vibration on visual acuity and trauma to the eye; (4) determine the effect of vibration in producing hearing loss; (5) recommend standards which limit vibration exposure to non-hazardous levels.

USAARL MULTI AXIS HELICOPTER VIBRATION SIMULATOR



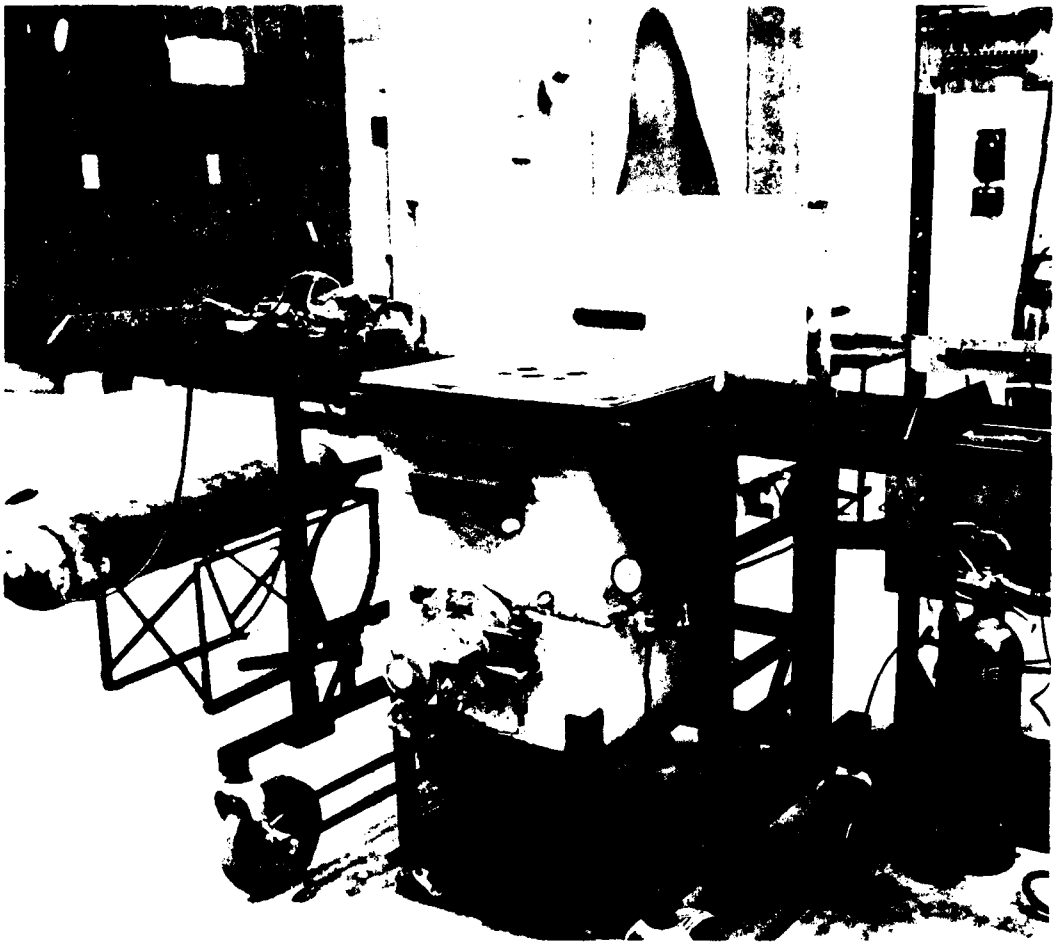
Achievements: The contribution of vibration to human tracking error in visually coupled systems (VCS) was defined and a data base for modeling the human aspects of VCS was developed. A technique for measuring muscle stress in the vibration environment was developed. The muscle stress induced by helmets of the Personnel Armor System for Ground Troops (PASGT) was evaluated in the vibration environment. A technique for quantifying vibration induced muscle synchronization was developed. Specimens of vibration exposed joint material from miniature swine were prepared for analysis and arthritic human tissue was obtained for comparison. An assessment program for the vibration hazards (visual, auditory, muscular, endocrine) associated with supine seats in tracked vehicles was developed under contract from the Tank and Automotive R&D Command.

Projects: The problem of backache must be investigated as an additional stress and fatigue problem and incorporated into the findings of other researchers who are working on aviator stress and fatigue factors and crew work/rest guidelines. We must develop a standardized technique for analyzing the effects of muscle stressors, both dynamic and static. This will include the determination of muscle stress induced by diverse items of military equipment. The magnitude and characteristics of the health hazards to the crewmember of the supine or prone seating position in the modern combat vehicle must be determined.

DD 1498s: The DD 1498 under which the work for this program is carried on is: (See p. 74.)

*Health Hazard Assessment and Implications of Whole-Body Vibration Associated with Advanced Combat Vehicle Technologies; program element 6.26.01, project number 1L162601AH91, and program element 6.27.73.A, 3E162773A819, work unit number 046.

*(See page 21.)



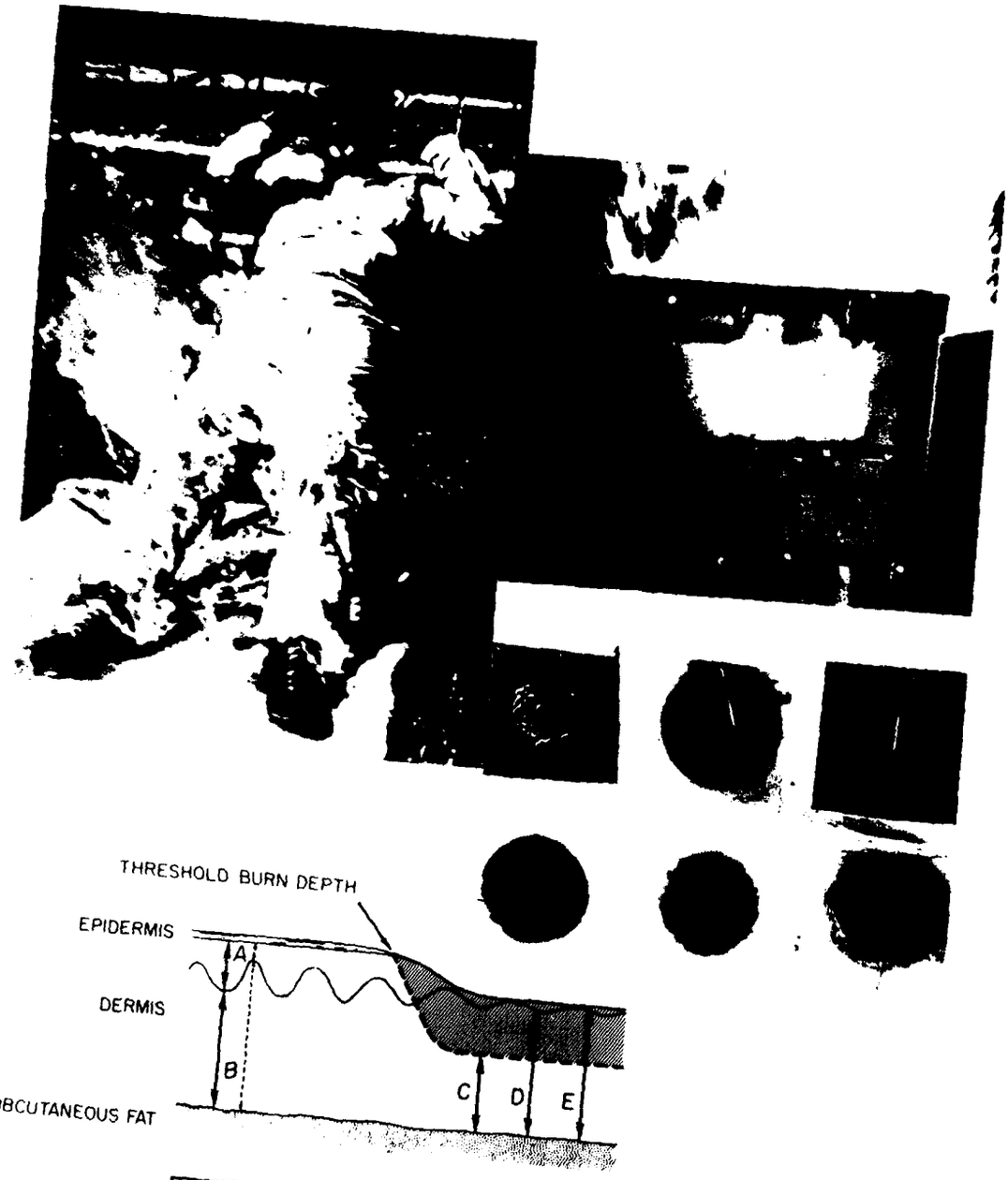
Thermal Analysis Program

Background: Military pilots, aircrew members, and passengers are subjected to the threat of fire during "hot" refueling, in-flight accidents, and postcrash sequences. Many approaches may be taken to protect people under such circumstances and include elimination of the fire threat, more efficient means of fire fighting and rescue, and provision for a thermally-protected micro-environment for the crew through the use of thermal protective clothing.

Biomedical support and input to the engineering solutions necessary for fire prevention involve epidemiologic studies on the morbidity and mortality of thermal injuries in survivable accidents, cost and operational effective analyses of these injuries and fatalities, and recommendations that influence the extent and severity of a fuel system modification and the extend of retrofit. The minimization of burns through the provision of thermal protective clothing requires more than a physical evaluation of the candidate fabrics; it also requires an assay of the biologic response of skin to a typical postcrash fire heat flux and time exposure both unprotected and protected by candidate materials.

USAARL's epidemiologic contributions to the implementation of the helicopter crashworthy fuel system into the entire helicopter fleet are well established. Army Safety Center data and recent USAARL reports have shown that the helicopter crashworthy fuel system has essentially eliminated postcrash fires in helicopters along with thermal morbidity and mortality.

Biomedical assay of candidate thermal protective fabrics is a necessity. Gaining or losing as little as one second of protection time because of the manipulation of the thickness, weave, or composition of a fabric can have a devastating effect on human tolerance and survivability. Assay of fabrics through purely physical means in the laboratory or on manikins in a fire pit without the use of sensors calibrated to human skin response will not give biologic information that is useful for decision making.



A	NORMAL EPIDERMAL THICKNESS
B	NORMAL DERMAL THICKNESS
C	"BURN DEPTH"
D	DERMAL THICKNESS AT BURN
E	TOTAL SKIN THICKNESS AT BURN

Thus, the thermal analysis program began in 1970 as a long-range, comprehensive, and aggressive evaluation of the entire correlation between helicopter postcrash fire, morbidity, mortality, and the development of contributory or supportive preventive technologies.

Objective: The current objective is to establish a correlation between the thermal chemical parameters measured by physical sensors and the damage to analog animal tissue when both physical sensors and animal tissue are exposed to identical thermal loads. Extrapolation of the analog animal skin mechanics to human skin is being done mathematically and correlated with clinical data. Empirical and analytical mathematical models are sought which accurately and efficiently predict the degree of thermal injury resulting from thermal energy transmitted through protective clothing or emanating from flammable clothing. The models must predict the entire continuum of clinical burns and be able to accept thermal loads from minor to what has been established as the worst credible survivable environment.

Achievements: Complete description of the helicopter postcrash fire including chemical, thermal, and physical dynamics, rescue and escape times. Demonstration of the inefficiency of advanced fire suppression and crash rescue systems in reducing morbidity and eliminating mortality. Development of a reproducible porcine bioassay method for studying thermal biomechanics of skin and evaluation of thermal protective clothing. Use of the bioassay technique to evaluate various uniform and winter underwear combinations. Bioassay of numerous production and experimental fabrics and polymers. Determination of wound healing characteristics influenced by fabric dye off-gasing products. Establishment of a vast standardized porcine skin thermal injured data base. Evaluation, calibration, and correlation of a large variety of physical thermal sensors to the biologic data base. Creation of a number of analytical and empirical math models to replace the bioassay technique.

Projects: Current project efforts involve publication of work completed. Significant efforts are being expended to refine and tune the most promising mathematical model which has been shown to be able to predict accurately the clinical response of skin from erythema through blistering to charring when exposed to a variety of thermal inputs.

Appendix A

Research and Technology Work Unit Summaries (DD 1498's) for FY 79

RESEARCH AND TECHNOLOGY WORK UNIT SUMMARY

1. AGENCY ACCESSION	2. DATE OF SUMMARY	REPORT CONTROL SYMBOL
DA OB 0889	79 10 01	DD DR&E(AR)636

3. DATE PREV SUM'RY	4. KIND OF SUMMARY	5. SUMMARY SCTY	6. WORK SECURITY	7. REGRADING	8a. DISP'N INSTR'N	8b. SPECIFIC DATA: CONTRACTOR ACCESS	9. LEVEL OF SUM
78 10 01	D. Change	U	U	NA	NL	☒ YES ☐ NO	A. WORK UNIT

10. NO./CODES:	PROGRAM ELEMENT	PROJECT NUMBER	TASK AREA NUMBER	WORK UNIT NUMBER
a. PRIMARY	6.11.02.A	3E161102BS07	00	026
b. CONTRIBUTING				
c. CONTRIBUTING	CARDS 114	(f) (m)		

11. TITLE (Precede with Security Classification Code)

(U) Military Acoustic Hazards; Mechanisms of Hearing Loss

12. SCIENTIFIC AND TECHNOLOGICAL AREAS 000200 Acoustics; 012400 Personnel Selection and Maintenance (*medical*); 007900 Industrial (occupational) Medicine

13. START DATE	14. ESTIMATED COMPLETION DATE	15. FUNDING AGENCY	16. PERFORMANCE METHOD
76 10	CONT	DA	C. In-House

17. CONTRACT/GRANT

a. DATES/EFFECTIVE: EXPIRATION

b. NUMBER:

c. TYPE: d. AMOUNT:

e. KIND OF AWARD: f. CUM. AMT.

18. RESOURCES ESTIMATE	a. PROFESSIONAL MAN YRS	b. FUNDS (In thousands)
FISCAL YEAR PRECEDING 79	2.9	183
FISCAL YEAR CURRENT 80	3.9	212

19. RESPONSIBLE DOD ORGANIZATION

NAME: US Army Aeromedical Research Lab

ADDRESS: Ft. Rucker, AL 36362

RESPONSIBLE INDIVIDUAL

NAME: Knapp, Stanley, C., COL, CDR

TELEPHONE: (205) 255-5107

20. PERFORMING ORGANIZATION

NAME: US Army Aeromedical Research Lab
Human Tolerance & Survivability Div

ADDRESS: Ft. Rucker, AL 36362

PRINCIPAL INVESTIGATOR (Furnish SSAN if U.S. Academic Institution)

NAME: Burdick, Charles K., CPT, MSC, Ph.D

TELEPHONE (205) 255-4408

SOCIAL SECURITY ACCOUNT NUMBER

ASSOCIATE INVESTIGATORS

NAME: Patterson, James H., Ph.D.

NAME: Mozo, Ben T.

21. GENERAL USE

Foreign Intelligence Considered

22. KEYWORDS (Precede EACH with Security Classification Code) (U) Acoustics, (U) Personnel Selection and Maintenance (medical); (U) Industrial (occupational) medicine; (U) Aircraft; (U) Combat Vehicles

23. TECHNICAL OBJECTIVE. 24. APPROACH. 25. PROGRESS (Furnish individual paragraphs identified by number. Precede text of each with Security Classification Code.)

23. (U) To establish valid damage risk criteria to insure the adequate hearing protection of Army personnel exposed to continuous noise.

24. (U) Behavioral, histological, and electrophysiological prodecures are used with animal models and audiometric and psychophysical procedures are used with human subjects

25. (U) 7810-7909. Effort has continued to identify and quantify the effects on hearing of exposure to high-intensity, low-frequency noise. Histological evaluation of the cochleae of chinchillas exposed to low-frequency noise tentatively indicates that the mechanism of injury may differ somewhat from that found with high frequency noise. That is, high frequency noise produces lesions in the sensory cells of the chochlea, while very few, if any, lesions have been found in cochleae exposed to low frequency noise. A group of chinchillas was exposed to octave-band noise centered at 1.0 kHz for 9 days with essentially the same hearing losses found in a previous study. These animals will under go analysis of the output of the 8th nerve by making electrophysiological recordings from single units of the nerve to determine changes in cochlear functions as a function of the noise exposure. Groups of chinchillas were also exposed to octave band noise centered at 63 Hz at 130 dB and octave-band noise centered at 125 Hz at 110 dB. Both exposures produced maximum hearing losses in the 2.0 2.8 kHz region, replicating that low-frequency noise produces high-frequency hearing loss. Data collection began on an extramural contract to determine the cochlear microphonic response of the chinchilla's ear to 63 Hz octave band noise. This electrophysiological data will be used to determine the intracochlear response to this low frequency noise which will improve our understanding of the mechanisms involved in hearing loss to low frequency noise.

*Available to contractors upon originator's approval

DD FORM 1498 1 MAR 65 PREVIOUS EDITIONS OF THIS FORM ARE OBSOLETE DD FORMS 1498A 1 NOV 68 AND 1498-1 1 MAR 68 (FOR ARMY USE) ARE OBSOLETE

RESEARCH AND TECHNOLOGY WORK UNIT SUMMARY

1. AGENCY ACCESSION	2. DATE OF SUMMARY	REPORT CONTROL SYMBOL
DA OB 6886	79 10 01	DD-DR&E(AR)636

3. DATE PREV SUM'RY	4. KIND OF SUMMARY	5. SUMMARY SCTY	6. WORK SECURITY	7. REGRADING	8a. DISP'N INSTR'N	8b. SPECIFIC DATA-CONTRACTOR ACCESS	9. LEVEL OF SUM
78 10 01	D. Change	U	U	NA	NA	☒ YES ☐ NO	A. WORK UNIT

10. NO./CODES:	PROGRAM ELEMENT	PROJECT NUMBER	TASK AREA NUMBER	WORK UNIT NUMBER
a. PRIMARY	6.27.73.A	3E162773A819	00	050
b. CONTRIBUTING	6.11.02.A	3E161102BS07	00	023
c. /~~/~~/~~/~~/~~/	CARDS 114 (l) (m)			

11. TITLE (Precede with Security Classification Code)

(U) Medical Assessment of Hearing Protective Devices

12. SCIENTIFIC AND TECHNOLOGICAL AREAS: 000200 Acoustics; 013300 Protective Equipment; 007900 Industrial (occupational) Medicine

13. START DATE	14. ESTIMATED COMPLETION DATE	15. FUNDING AGENCY	16. PERFORMANCE METHOD
76 10	CONT	DA	In-House

17. CONTRACT/GRANT

a. DATES/EFFECTIVE: EXPIRATION:

b. NUMBER:

c. TYPE: d. AMOUNT:

e. KIND OF AWARD: f. CUM. AMT.

18. RESOURCES ESTIMATE	a. PROFESSIONAL MAN YRS	b. FUNDS (In thousands)
FISCAL YEAR PRECEDING 79	2.9	136
FISCAL YEAR CURRENT 80	2.1	187

19. RESPONSIBLE DOD ORGANIZATION

NAME: US Army Aeromedical Research Lab

ADDRESS: Fort Rucker, AL 36362

RESPONSIBLE INDIVIDUAL

NAME: KNAPP, Stanley C., COL, Cdr

TELEPHONE: (205) 255-5107

20. PERFORMING ORGANIZATION

NAME: US Army Aeromedical Research Lab
Human Tolerance & Survivability Div

ADDRESS: Fort Rucker, AL 36362

PRINCIPAL INVESTIGATOR (Furnish SSAN if U.S. Academic Institution)

NAME: MOZO, Ben T.

TELEPHONE: (205) 255-4408

SOCIAL SECURITY ACCOUNT NUMBER

ASSOCIATE INVESTIGATORS

NAME: CAMP, Robert T., Jr.

NAME: GOLDSTEIN, Jerod, MAJ

21. GENERAL USE

Foreign Intelligence Considered

22. KEYWORDS (Precede EACH with Security Classification Code) (U) Acoustics; (U) Protective Equipment; (U) Industrial (occupational) Medicine; (U) Aircraft; (U) Radio Communication; (U) Weapons Effects

23. TECHNICAL OBJECTIVE, 24. APPROACH, 25. PROGRESS (Furnish individual paragraphs identified by number. Precede text of each with Security Classification Code.)

23. (U) This research assesses the sound-attenuating characteristics of hearing protective devices as to their suitability to meet the needs of the Army and develops new hearing protective devices and methods for evaluating them.

24. (U) Methods utilized for the determination of the sound attenuation characteristics of hearing protective devices will be ANSI Z22.24-1957 and ASA STD 1-1975. Objective electroacoustic methods will also be used.

25. (U) 7810-7909. ASA STD 1-1975 real ear attenuation characteristics of hearing protective devices standard method was implemented. All the requirements of the standard have been met, and the measurement of the real ear attenuation characteristics of the hearing protective devices using this method will begin in FY 80. The evaluation of the real ear attenuation characteristics of SPH-4 manufactured by two companies was completed. Nine hearing protective devices identified in the Qualified Products List of products were evaluated and qualified under Mil Spec MIL-P-38268. USAARL Report No. 79-10 was published. The evaluation of the Bilsom Prop-O-Plast was completed. USAARL Report No. USAARL LR-79-10-2-5 was completed. Reports are presently in progress on the comparison of real ear attenuation characteristics of the E-A-R earplug and the Deci-Damp earplug, and the training effect on the attenuation of the E-A-R earplug. A method of measuring the sound attenuation characteristics of circumaural hearing protectors by physical method is presently in development.

* Available to contractors upon originator's approval

DD FORM 1 MAR 68 1498 PREVIOUS EDITIONS OF THIS FORM ARE OBSOLETE. DD FORMS 1498A * NOV 68 AND 1498-1 1 MAR 68 (FOR ARMY USE) ARE OBSOLETE

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RESEARCH AND TECHNOLOGY WORK UNIT SUMMARY

1. AGENCY ACCESSION	2. DATE OF SUMMARY	REPORT CONTROL SYMBOL
	79 10 01	DD DR&E(AR)636

3. DATE PREV SUM'RY	4. KIND OF SUMMARY	5. SUMMARY SCTY	6. WORK SECURITY	7. REGRADING	8a. ORG'N INSTR'N	8b. SPECIFIC DATA-CONTRACTOR ACCESS	9. LEVEL OF SUM
78 11 14	D. Change	U	U	NA	NL	☒ YES ☐ NO	A. WORK UNIT

10. NO. CODES:	PROGRAM ELEMENT	PROJECT NUMBER	TASK AREA NUMBER	WORK UNIT NUMBER
a. PRIMARY	6.37.47.A	1L263747D669-32-004	00	051
b. CONTRIBUTING				
c. CONTRIBUTING				

11. TITLE (Precede with Security Classification Code)

(U) Combat Vehicle Crewman (CVC) Helmet - Impact and Acoustical Evaluation

12. SCIENTIFIC AND TECHNOLOGICAL AREAS

000200 Acoustics; 013300 Protective Equipment; 003700 Combat Vehicles

13. START DATE	14. ESTIMATED COMPLETION DATE	15. FUNDING AGENCY	16. PERFORMANCE METHOD
78 12	82--01	DA	C. In-House

17. CONTRACT GRANT

a. DATES/EFFECTIVE — EXPIRATION

b. NUMBER

c. TYPE — d. AMOUNT

e. KIND OF AWARD — f. CUM. AMT.

18. RESOURCES ESTIMATE	a. PROFESSIONAL MAN YRS	b. FUNDS (In thousands)
FISCAL YEAR PRECEDING 79	3.3	160
FISCAL YEAR CURRENT 80	2.6	185

19. RESPONSIBLE DOD ORGANIZATION

NAME: US Army Aeromedical Research Lab

ADDRESS:

RESPONSIBLE INDIVIDUAL

NAME: Knapp, Stanley C., COL, Cdr

TELEPHONE: (205) 255-5107

20. PERFORMING ORGANIZATION

NAME: US Army Aeromedical Research Lab
Human Tolerance & Survivability Div

ADDRESS: Fort Rucker, AL 36362

PRINCIPAL INVESTIGATOR (Furnish SSAN if U.S. Academic Institution)

NAME: Camp, R. and Hundley, T.

TELEPHONE: (205) 255-4408

SOCIAL SECURITY ACCOUNT NUMBER

21. GENERAL USE

Foreign Intelligence Considered

ASSOCIATE INVESTIGATORS

NAME: Mozo, B.

NAME: Patterson, J.

22. KEYWORDS (Precede EACH with Security Classification Code)

(U) Acoustics; (U) Protective Equipment; (U) Combat Vehicles; (U) Radio Communication

23. TECHNICAL OBJECTIVE. 24. APPROACH. 25. PROGRESS (Furnish individual paragraphs identified by number. Precede text of each with Security Classification Code.)

23. (U) Develop a CVC Helmet which provides acoustic and impact protection and high quality voice communication without hearing damage.

24. (U) The approach is to: (1) measure impulse noise of combat vehicles, (2) establish sound attenuation requirements for adequate protection in CVC environment, (3) establish electro-acoustic characteristics for equipment to assure compliance with hearing conservation requirements, (4) investigate ear seal configuration for maximum sound attenuation, (5) evaluate impact hazards in combat vehicles and specify design criteria, (6) determine need and design of a suspension and retention system, and, (7) determine qualification test procedures.

25. (U) 7811-7909. Progress is shown by publication of USAARL Report 78-12 which involved a medical evaluation of sound attentuation and electro-acoustic characteristics of a prototype DH-178 protective helmet containing an active hearing protector that may be proposed for use around some weapon systems. The specialized equipment necessary for measuring impulse noise in the field has been partially received and assembled. Preliminary examination of the data correlating physical ear and real-ear attenuation measurements has been initiated. Data on accidents involving head injury was obtained from USASC and is being reviewed. Limited user opinion survey on the DH-132 helmet was conducted at Ft. Knox. A similar survey is being prepared for distribution to units in Europe. The M-60, M-113, M-109, M110 and XM-1 were examined for impact surface hazards. The monorail drop tower was procured. The experimental plans developed for this investigation were presented to a Working Group of the National Research Council.

* Available to contractors upon originator's approval

DD FORM 1498 PREVIOUS EDITIONS OF THIS FORM ARE OBSOLETE AND 1498-1 MAR 68 FOR ARMY USE ARE OBSOLETE

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RESEARCH AND TECHNOLOGY WORK UNIT SUMMARY

1. AGENCY ACCESSION	2. DATE OF SUMMARY	REPORT CONTROL SYMBOL
	79 10 01	DD DR&E(AR)636

3. DATE PREV SUM'RY	4. KIND OF SUMMARY	5. SUMMARY SCTY	6. WORK SECURITY	7. REGRADING	8A. DISP'N INSTR'N	8b. SPECIFIC DATA: CONTRACTOR ACCESS	9. LEVEL OF SUM
78 11 01	D. CHANGE	U	U			☒ YES ☐ NO	A. WORK UNIT

10. NO. CODES	PROGRAM ELEMENT	PROJECT NUMBER	TASK AREA NUMBER	WORK UNIT NUMBER
a. PRIMARY	6.11.02.A	3M161102BS01	00	041
b. CONTRIBUTING	6.27.73.A	3E162773A818		
c. CONTRIBUTING				

11. TITLE (Precede with Security Classification Code)
(U) Medical Effects of Blast Overpressure

12. SCIENTIFIC AND TECHNOLOGICAL AREAS 000200 Acoustics; 013300 Protective Equipment; 007900 Industrial (occupational) Medicine

13. START DATE	14. ESTIMATED COMPLETION DATE	15. FUNDING AGENCY	16. PERFORMANCE METHOD
7710	1982	DA	C. In House

17. CONTRACT GRANT — Not Applicable
a. DATES/EFFECTIVE: — EXPIRATION
b. NUMBER
c. TYPE: — d. AMOUNT
e. KIND OF AWARD: — f. CUM. AMT.

18. RESOURCES ESTIMATE		a. PROFESSIONAL MAN YRS	b. FUNDS (In thousands)
FISCAL YEAR	PRECEDING 79	2.5	365
	CURRENT 80	0	0

19. RESPONSIBLE DOD ORGANIZATION
NAME: Walter Reed Army Institute of Research
ADDRESS: Washington, DC 20012

RESPONSIBLE INDIVIDUAL
NAME: Alstatt, Leslie B., COL, MC
TELEPHONE: (202) 576 3236

20. PERFORMING ORGANIZATION
NAME: US Army Aeromedical Research Lab
ADDRESS: Human Tolerance & Survivability Div
Ft. Rucker, AL 36362

PRINCIPAL INVESTIGATOR (Furnish SSAN if U.S. Academic Institution)
NAME: Patterson, James H., Ph.D.
TELEPHONE: (205) 255 4408
SOCIAL SECURITY ACCOUNT NUMBER

ASSOCIATE INVESTIGATORS
NAME: Mozo, Ben T.
NAME

21. GENERAL USE
Foreign Intelligence Considered

22. KEYWORDS (Precede EACH with Security Classification Code) (U) Acoustics; (U) Protective Equipment; (U) Industrial (occupational) Medicine; (U) Weapons Effects; (U) Impulse Noise

23. TECHNICAL OBJECTIVE. 24. APPROACH. 25. PROGRESS (Furnish individual paragraphs identified by number preceded text of each with Security Classification Code.)

23. (U) To define the physiologic effects upon the auditory system of blast over pressure generated by firing Army weapons systems in terms of the physical characteristics of the pressure wave responsible for injury to the auditory system and potential protective devices and mechanisms.

24. (U) The approach is three pronged: 1. Physical measurements to define the nature of the noise and on which to base hazard assessment. 2. Direct validation of hearing protective devices and development of indirect methods to determine their adequacy. 3. Basic animal and human studies to develop a data base for more accurate tolerance limits (damage risk criteria) for impulse noise.

25. (U) 7811 7909. During FY 79 measurements were made on the M198 M203 to determine the isohazard contours forward and to the sides of the cannon and the dynamic pressure of the blast wave in the crew area at different heights above the ground. The blast over pressures around and inside the M109 self propelled howitzer turret the M205 were determined. The development of a large animal model was initiated under a contract to develop training and audiometric test procedures for the [illegible] pig. A study of the role of peak pressure on auditory damage from impulse noise was initiated.

*Available to contractors upon originator's approval

DD FORM 1498 [illegible]

RESEARCH AND TECHNOLOGY WORK UNIT SUMMARY

1. AGENCY ACCESSION	2. DATE OF SUMMARY	REPORT CONTROL SYMBOL
DA 0B 6892	79 10 01	DD-DR&E(AR)636

3. DATE PREV SUM'RY	4. KIND OF SUMMARY	5. SUMMARY SCTY	6. WORK SECURITY	7. REGRADING	8a. DISP'N INSTR'N	8b. SPECIFIC DATA CONTRACTOR ACCESS	9. LEVEL OF SUM
78 10 01	D. Change	U	U	NA	NL	[X] YES [ ] NO	A. WORK UNIT

10. NO. CODES	PROGRAM ELEMENT	PROJECT NUMBER	TASK AREA NUMBER	WORK UNIT NUMBER
a. PRIMARY	6.27.73A	3E162773A819	00	003
b. CONTRIBUTING				
c. [illegible]	CARDS (f)	(m)		

11. TITLE (Precede with Security Classification Code)

(U) Research of Electro-Optical Systems and the Human Visual System

12. SCIENTIFIC AND TECHNOLOGICAL AREAS

001300 Aircraft; 012000 Optics; 012900 Physiology

13. START DATE	14. ESTIMATED COMPLETION DATE	15. FUNDING AGENCY	16. PERFORMANCE METHOD
76 10	CONT	DA	C. In-House

17. CONTRACT GRANT

a. DATES/EFFECTIVE — EXPIRATION

b. NUMBER

c. TYPE — d. AMOUNT

e. KIND OF AWARD — f. CUM. AMT.

18. RESOURCES ESTIMATE	a. PROFESSIONAL MAN YRS	b. FUNDS (In thousands)
FISCAL YEAR — PRECEDING	79	4.0	93
FISCAL YEAR — CURRENT	80	4.7	116

19. RESPONSIBLE DOD ORGANIZATION

NAME: US Army Aeromedical Research Laboratory

ADDRESS: Fort Rucker, AL 36362

RESPONSIBLE INDIVIDUAL

NAME: Knapp, Stanley, C., COL, CDR

TELEPHONE: (205) 255-5107

20. PERFORMING ORGANIZATION

NAME: US Army Aeromedical Research Lab
Human Tolerance & Survivability Div

ADDRESS: Fort Rucker, AL 36362

PRINCIPAL INVESTIGATOR (Furnish SSAN if U.S. Academic Institution)

NAME: Verona, R. W., CPT

TELEPHONE: (205) 255-6808/6415

SOCIAL SECURITY ACCOUNT NUMBER

ASSOCIATE INVESTIGATORS

NAME: Holly, F. F., CPT

NAME:

21. GENERAL USE

Foreign Intelligence Considered

22. KEYWORDS (Precede EACH with Security Classification Code) (U) Aircraft; (U) Electro-Optical Systems; (U) Vision; (U) Target Detection; (U) Display Color; (U) Visual Sensitivity; (U) Night Vision

23. TECHNICAL OBJECTIVE; 24. APPROACH; 25. PROGRESS (Furnish individual paragraphs identified by number. Precede text of each with Security Classification Code.)

23. (U) To provide information about the effects of military electro-optical viewing and display systems on the human visual system and to determine optimum display characteristics to match the capabilities of the visual system.

24. (U) The approach will involve visual psychophysical procedures and the electro optically generated targets will be verified with static and scanning photometric and colorimeteric techniques.

25. (U) 7810-7909. The spatial and spectral scanning photometer/radiometer previously used to measure static display quality, as discussed in USAARL RPT 79-13 "A Direct Measure of CRT Image Quality", has been modified to analyze dynamic image quality too. The techniques and procedures for reliably analyzing dynamic image quality are still in developmental stages. These procedures will be finalized prior to the dynamic imagery studies. The second static imagery study "The Effects of Various Television Display Phosphors on Tactical Vehicle Visual Thresholds" is being prepared for publication. Dynamic contrast sensitivity and dynamic vehicle visual threshold data for the various common display phosphors will be collected during this fiscal year. The electronic sine wave generator for the contrast sensitivity study is on-hand, and the dynamic imagery for the dynamic vehicle threshold study is being collected at the present time. A variable frame rate 16 mm flying spot scanner film to video connected will be delivered in April 80.

*Available to contractors upon originator's approval

DD FORM 1498 (MAR 68) — PREVIOUS EDITIONS OF THIS FORM ARE OBSOLETE. DD FORMS 1498A (NOV 68) AND 1498-1 (MAR 68) FOR ARMY USE ARE OBSOLETE

* U.S. GPO 1974-540 843 8691

RESEARCH AND TECHNOLOGY WORK UNIT SUMMARY

1. AGENCY ACCESSION	2. DATE OF SUMMARY	REPORT CONTROL SYMBOL
DA OB 6893	79 10 01	DD-DR&E(AR)636

3. DATE PREV SUM'RY	4. KIND OF SUMMARY	5. SUMMARY SCTY	6. WORK SECURITY	7. REGRADING	8. DOD'N INSTR'N	9. SPECIFIC DATA: CONTRACTOR ACCESS	9. LEVEL OF SUM
78 10 01	D. Change	U	U	NA	NL	☒ YES ☐ NO	A. WORK UNIT

10. NO./CODES	PROGRAM ELEMENT	PROJECT NUMBER	TASK AREA NUMBER	WORK UNIT NUMBER
a. PRIMARY	6.27.73.A	3E162773A819	00	004
b. CONTRIBUTING				
c. CONTRIBUTING				

11. TITLE (Precede with Security Classification Code)

(U) Visual and Optical Evaluation of Nonmedical Materiel

12. SCIENTIFIC AND TECHNOLOGICAL AREAS

001300 Aircraft; 012000 Optics; 012900 Physiology

13. START DATE	14. ESTIMATED COMPLETION DATE	15. FUNDING AGENCY	16. PERFORMANCE METHOD
76 10	CONT	DA	C. In-House

17. CONTRACT/GRANT

a. DATES/EFFECTIVE: EXPIRATION

b. NUMBER:

c. TYPE: d. AMOUNT:

e. KIND OF AWARD: f. CUM. AMT.

18. RESOURCES ESTIMATE	a. PROFESSIONAL MAN YRS	b. FUNDS (In thousands)
FISCAL YEAR PRECEDING 79	3.0	54
FISCAL YEAR CURRENT 80	4.9	151

19. RESPONSIBLE DOD ORGANIZATION

NAME: US Army Aeromedical Research Laboratory

ADDRESS: Fort Rucker, AL 36362

RESPONSIBLE INDIVIDUAL

NAME: KNAPP, Stanley C., COL, Cdr

TELEPHONE: (205) 255 5107

20. PERFORMING ORGANIZATION

NAME: US Army Aeromedical Research Lab
Human Tolerance & Survivability Div

ADDRESS: Fort Rucker, AL 36362

PRINCIPAL INVESTIGATOR (Furnish SSAN if U.S. Academic Institution)

NAME: BEHAR, I.

TELEPHONE: (205) 255-6808/6415

SOCIAL SECURITY ACCOUNT NUMBER

ASSOCIATE INVESTIGATORS

NAME: HOLLY, F. F., CPT

NAME:

21. GENERAL USE

Foreign Intelligence Considered

22. KEYWORDS (Precede EACH with Security Classification Code) (U) Aircraft; (U) Cockpit Lighting; (U) Optical Aberrations; (U) Vision; (U) Photometry; (U) Colorimetry; (U) Optical Transparencies

23. TECHNICAL OBJECTIVE, 24. APPROACH, 25. PROGRESS (Furnish individual paragraphs identified by number. Precede text of each with Security Classification Code.)

23. (U) To provide information on those aspects of the ambient or instrument environment which might adversely affect or enhance the human visual system and military operational activity dependent upon visual performance.

24. (U) The approach will include physical optics techniques, photometry, spectrometry, and colorimetry to measure the fidelity, magnitude, and temporal characteristics of the visual environment and, using psychophysical procedures, determine the effects of the visual stimuli on visual performance.

25. (U) 7810 7909. Progress is shown in: USAARL LR 79 2 3 2, Jan 79, An Evaluation of the Lighting of the Tactical Air Traffic Control Tower (TSW 7) for Blackout and Night Vision Goggle Compatibility; USAARL LR 79 7 2 2, Jun 79, Bio Optical Evaluation of UH 1H Armor Windshield; and in reports in preparation: Lighting Evaluation of the AH 1 (Cobra) Simulator; Mathematical Formulation and Computer Analysis of Minimization of Cockpit Reflections; and An Evaluation of Light Control Film™ for Reducing Reflections within the AH 1S Aircraft.

* Available from contributing organization's approval

DD FORM 1498 [illegible]

RESEARCH AND TECHNOLOGY WORK UNIT SUMMARY

1. AGENCY ACCESSION	2. DATE OF SUMMARY	REPORT CONTROL SYMBOL
DA OB 6891	79 10 01	DD-DR&E(AR)636

3. DATE PREV SUM'RY	4. KIND OF SUMMARY	5. SUMMARY SCTY	6. WORK SECURITY	7. REGRADING	8a. DISP'N INSTR'N	8b. SPECIFIC DATA-CONTRACTOR ACCESS	9. LEVEL OF SUM
78 10 01	D. Change	U	U	NA	NL	☐ YES ☐ NO	A. WORK UNIT

10. NO./CODES:	PROGRAM ELEMENT	PROJECT NUMBER	TASK AREA NUMBER	WORK UNIT NUMBER
a. PRIMARY	6.11.02.A	3E161102BS07	00	028
b. CONTRIBUTING	6.27.73.A	3E162773A819	00	002
c. [illegible]	CARDS 114	(U) (m)		

11. TITLE (Precede with Security Classification Code)

(U) Research of Visual Problems Medically Significant to the Army

12. SCIENTIFIC AND TECHNOLOGICAL AREAS

001300 Aircraft; 012000 Optics; 012900 Physiology

13. START DATE	14. ESTIMATED COMPLETION DATE	15. FUNDING AGENCY	16. PERFORMANCE METHOD
76 10	CONT	DA	C. In-House

17. CONTRACT/GRANT

a. DATES/EFFECTIVE: EXPIRATION:

b. NUMBER:

c. TYPE: d. AMOUNT:

e. KIND OF AWARD: f. CUM. AMT.

18. RESOURCES ESTIMATE	a. PROFESSIONAL MAN YRS	b. FUNDS (In thousands)
FISCAL YEAR — PRECEDING	79	2.1	87
FISCAL YEAR — CURRENT	80	4.7	128

19. RESPONSIBLE DOD ORGANIZATION

NAME: US Army Aeromedical Research Laboratory

ADDRESS: Fort Rucker, AL 36362

RESPONSIBLE INDIVIDUAL

NAME: Knapp, Stanley C., COL, CDR

TELEPHONE: (205) 255-5107

20. PERFORMING ORGANIZATION

NAME: US Army Aeromedical Research Lab
Human Tolerance & Survivability Div

ADDRESS: Ft. Rucker, AL 36362

PRINCIPAL INVESTIGATOR (Furnish SSAN if U.S. Academic Institution)

NAME: Holly, F.

TELEPHONE: (205) 255-6808/6415

SOCIAL SECURITY ACCOUNT NUMBER

ASSOCIATE INVESTIGATORS

NAME: Behar, I.

NAME:

21. GENERAL USE

Foreign Intelligence Considered

22. KEYWORDS (Precede EACH with Security Classification Code) (U) Aircraft; (U) Vision; (U) Man-Machine Interface; (U) Visual Psychophysics; (U) Night Vision; (U) Visual Correction; (U) Visual Protection

23. TECHNICAL OBJECTIVE. 24. APPROACH. 25. PROGRESS (Furnish individual paragraphs identified by number. Precede text of each with Security Classification Code.)

23. (U) To provide information about the visual sensory modality relating to capability of the human visual system and the impact of military equipment, environmental and operational influences on visual performance and integrity.

24. (U) The approach will include psychophysical, electrophysiological, and other objective techniques to evaluate human visual performance with quantitative measures.

25. (U) 7810 7909. The current work in this area evaluated an aviation problem in which pilots were seeing double flashes when in fact the source was a single pulse. The double flashes occur at a frequency of approximately ten Hertz. These auto oscillations are now believed to be related to oscillatory potentials recorded from retina and cortex.

*Available to contractors upon originator's approval

DD FORM 1 MAR 88 1498 PREVIOUS EDITIONS OF THIS FORM ARE OBSOLETE. DD FORMS 1498A 1 NOV 68 AND 1498-1 1 MAR 88 (FOR ARMY USE) ARE OBSOLETE

RESEARCH AND TECHNOLOGY WORK UNIT SUMMARY

1. AGENCY ACCESSION	2. DATE OF SUMMARY	REPORT CONTROL SYMBOL
DA OG 0153	79 09 30	DD-DR&E(AR)636

3. DATE PREV SUMRY	4. KIND OF SUMMARY	5. SUMMARY SCTY	6. WORK SECURITY	7. REGRADING	8a. DISP'N INSTR'N	8b. SPECIFIC DATA: CONTRACTOR ACCESS	9. LEVEL OF SUM
78 10 01	D. CHANGE	U	U	NA	NL	XX YES ☐ NO	A. WORK UNIT

10. NO./CODES:	PROGRAM ELEMENT	PROJECT NUMBER	TASK AREA NUMBER	WORK UNIT NUMBER
a. PRIMARY	6.27.73.A	3E162773A819	00	001
b. CONTRIBUTING				
c. CONTRIBUTING				

11. TITLE (Procede with Security Classification Code): (U) Research Directed at Biomedical Parameters Affecting Aircrew Workload During Sustained Operations

12. SCIENTIFIC AND TECHNOLOGICAL AREAS:
013400 Psychology; 001300 Aircraft; 016200 Stress Physiology

13. START DATE	14. ESTIMATED COMPLETION DATE	15. FUNDING AGENCY	16. PERFORMANCE METHOD
78 10	CONT	DA	C. In-House

17. CONTRACT/GRANT
a. DATES/EFFECTIVE: NA EXPIRATION:
b. NUMBER:
c. TYPE: d. AMOUNT:
e. KIND OF AWARD: f. CUM. AMT.

18. RESOURCES ESTIMATE	a. PROFESSIONAL MAN YRS	b. FUNDS (In thousands)
FISCAL YEAR PRECEDING 79	5.5	265
FISCAL YEAR CURRENT 80	8.9	292

19. RESPONSIBLE DOD ORGANIZATION
NAME: US Army Aeromedical Research Laboratory
ADDRESS: Fort Rucker, AL 36362

RESPONSIBLE INDIVIDUAL
NAME: Knapp, S. C., COL, Cdr
TELEPHONE: (205) 255-5107

21. GENERAL USE
Foreign Intelligence Considered

20. PERFORMING ORGANIZATION
NAME: US Army Aeromedical Research Laboratory Field Research & Biomedical Applications
ADDRESS: Division, Fort Rucker, AL 36362

PRINCIPAL INVESTIGATOR (Furnish SSAN if U.S. Academic Institution)
NAME: Krueger, G. P., MAJ, MSC
TELEPHONE: (205) 255-3211
SOCIAL SECURITY ACCOUNT NUMBER

ASSOCIATE INVESTIGATORS
NAME: Whitehurst, L. R., MAJ, MC, FS
NAME: Stone, L. W., DAC

22. KEYWORDS (Precede EACH with Security Classification Code): (U) Man-Machine Relations; (U) Military Aircraft; (U) Psychology; (U) Aviation Medicine; (U) Stress; (U) Sustained Operations; (U) Human Volunteers

23. TECHNICAL OBJECTIVE, 24. APPROACH, 25. PROGRESS (Furnish individual paragraphs identified by number. Precede last of each with Security Classification Code.)

23. (U) Little is known about the medical problems which extended operations have on helicopter aircrews. The objective of this project is to assess the biomedical parameters which affect aviation personnel during sustained military operations. The overall results of the research will provide a baseline criteria for: (a) physiologic measures of workload, stress and fatigue; (b) the effect of workload, stress, and fatigue on extended performance; (c) Army aviation personnel requirements for sustained operations; and (d) the fatigue and stress effects caused by special operational equipment such as night vision goggles or helmet mounted sight systems.

24. (U) The approach will involve the utilization of in-flight and simulator monitoring and recording systems capable of sampling and recording continuous analog and digital information in experiments designed to measure pilot performance and aircraft response. These recording systems and statistical techniques will be utilized to quantify and predict aviator performance levels and subsequent man-system efficiency as a function of extended military operations.

25. (U) 7810-7909. During FY 79 a methodology report entitled "The Measurement of Man-Helicopter Performance as a Function of Extended Flight Requirements and Aviator Fatigue" was completed. Two of three planned extensive multidisciplinary data collection exercises were completed in week-long simulator IFR flight operations. Survey data on aviation crew work/rest schedules were used in modeling aviator to aircraft seat ratios for sustained operations. These data were supplied to the TRADOC special study on Army Aviation Personnel Requirements for Sustained Operations (AAPRSO). Research personnel participated in the first transatlantic self-deployment of CH-47 helicopters without aerial refueling exercise. A proposal to conduct in-flight research on aviator fatigue in extensive use of night vision goggles was prepared.

DD FORM 1 MAR 66 1498 PREVIOUS EDITIONS OF THIS FORM ARE OBSOLETE. DD FORMS 1498A, NOV 68 AND 1498-1, 1 MAR 68 (FOR ARMY USE) ARE OBSOLETE

RESEARCH AND TECHNOLOGY WORK UNIT SUMMARY

1. AGENCY ACCESSION	2. DATE OF SUMMARY	REPORT CONTROL SYMBOL
DA OC 0156	79 09 30	DD-DR&E(AR)636

3. DATE PREV SUM'RY	4. KIND OF SUMMARY	5. SUMMARY SCTY	6. WORK SECURITY	7. REGRADING	8A. DISB'N INSTR'N	8B. SPECIFIC DATA-CONTRACTOR ACCESS	9. LEVEL OF SUM
78 10 01	D. CHANGE	U	U	NA	NI	[X] YES [ ] NO	A. WORK UNIT

10. NO. CODES	PROGRAM ELEMENT	PROJECT NUMBER	TASK AREA NUMBER	WORK UNIT NUMBER
a. PRIMARY	6.27.73.A	3E162773A819	00	010
b. CONTRIBUTING				
c. CONTRIBUTING				

11. TITLE (Precede with Security Classification Code)

(U) Visual Performance Research Related to Operational Problems in Army Aviation

12. SCIENTIFIC AND TECHNOLOGICAL AREAS

012900 Physiology; 009400 Man-Machine Relations; 013400 Psychology; 001300 Aircraft

13. START DATE	14. ESTIMATED COMPLETION DATE	15. FUNDING AGENCY	16. PERFORMANCE METHOD
78 10	CONT	DA	C. In-House

17. CONTRACT/GRANT

a. DATES/EFFECTIVE: NA — EXPIRATION:
b. NUMBER:
c. TYPE — d. AMOUNT:
e. KIND OF AWARD — f. CUM. AMT.:

18. RESOURCES ESTIMATE		a. PROFESSIONAL MAN YRS	b. FUNDS (In thousands)
FISCAL YEAR	PRECEDING 79	3.8	173
	CURRENT 80	5.7	214

19. RESPONSIBLE DOD ORGANIZATION

NAME: US Army Aeromedical Research Laboratory
ADDRESS: Fort Rucker, AL 36362

RESPONSIBLE INDIVIDUAL
NAME: Knapp, S. C., COL, Cdr
TELEPHONE: (205) 255-5107

20. PERFORMING ORGANIZATION

NAME: US Army Aeromedical Research Laboratory
ADDRESS: Field Research & Biomedical Applications Division, Ft Rucker, AL 36362

PRINCIPAL INVESTIGATOR (Furnish SSAN if U.S. Academic Institution)
NAME: Simmons, R. R., MS, DAC
TELEPHONE: (205) 255-3211
SOCIAL SECURITY ACCOUNT NUMBER

ASSOCIATE INVESTIGATORS
NAME: Kimball, K. A., Ph.D., DAC
NAME: Stone, L. W., MA, DAC

21. GENERAL USE

Foreign Intelligence Considered

22. KEYWORDS (Precede EACH with Security Classification Code) (U) Visual Performance; (U) Binocular Vision; (U) Eye Movement; (U) Military Aircraft; (U) Man-Machine Relations; (U) Psychology; (U) Recordin

23. TECHNICAL OBJECTIVE, 24. APPROACH, 25. PROGRESS (Furnish individual paragraphs identified by number. Precede text of each with Security Classification Code.)

23. (U) Visual perception to Army aircrews is critical for pilotage, navigation, and weapon utilization to fulfill various tactical requirements. The objective of this project is to provide US Army aviation information regarding the visual performance of fixed and rotary wing aviators during varying tactical missions. Special emphasis will be placed on the objective quantification and interpretation of these data and their relation to variables such as pilot physiological and psychological states and task loading.

24. (U) The approach will involve the utilization of an oculomotor monitoring and recording device for visual data collection during flight. Areas of research to be addressed will include: aviator visual performance during conditions of VFR, IFR, night, and nap-of-the-earth flights; day and night navigation; scout helicopter operations, and varying aircraft comparisons. Measurements of dwell times, scan rates, fixations, and zones of workload will be analyzed to provide visual performance criteria and models. Additionally, data collection equipment and techniques are being designed to provide the ability to record visual data under night flight conditions and data analyses project.

25. (U) 7810-7909. Previously, visual performance investigations were reported under accession numbers OB 6899 and OC 6886. Laboratory reports and findings can be reviewed in the previous two accession number reports. Current efforts have been directed at completing a computerized data base. This data base is 85% complete. Still lacking are data from aviators during attack helicopter operations. Additionally, data collection and analysis efforts have been extended to provide more sophisticated methods of interpreting visual information provided by in-flight programs.

*Available to contractors upon originator's approval

DD FORM 1498 MAR 80 — PREVIOUS EDITIONS OF THIS FORM ARE OBSOLETE. DD FORMS 1498-1 AND 1498-1 MAR 80 FOR ARMY USE ARE OBSOLETE.

RESEARCH AND TECHNOLOGY WORK UNIT SUMMARY

1. AGENCY ACCESSION	2. DATE OF SUMMARY	REPORT CONTROL SYMBOL
DA OG 0151	79 10 01	DD DR&E(AR)636

3. DATE PREV SUM'RY	4. KIND OF SUMMARY	5. SUMMARY SCTY	6. WORK SECURITY	7. REGRADING	8a. DISP'N INSTR'N	8b. SPECIFIC DATA - CONTRACTOR ACCESS	9. LE. EL OF SUM
78 10 01	D. Change	U	U	NA	NL	☒ YES ☐ NO	a. WORK UNIT

10. NO./CODES:	PROGRAM ELEMENT	PROJECT NUMBER	TASK AREA NUMBER	WORK UNIT NUMBER
a. PRIMARY	6.27.73.A	3E162773A819	00	020
b. CONTRIBUTING				
c. CONTRIBUTING				

11. TITLE (Precede with Security Classification Code): (U) Aeromedical Research of Operationally Significant Problems in the Army Aviation Environment

12. SCIENTIFIC AND TECHNOLOGICAL AREAS: 003500 Clinical Medicine; 012900 Physiology; 001300 Aircraft

13. START DATE	14. ESTIMATED COMPLETION DATE	15. FUNDING AGENCY			16. PERFORMANCE METHOD
78 10	CONT	DA			C. In-House

17. CONTRACT/GRANT
a. DATES/EFFECTIVE: NA EXPIRATION:
b. NUMBER:
c. TYPE: d. AMOUNT:
e. KIND OF AWARD: f. CUM. AMT.

18. RESOURCES ESTIMATE	a. PROFESSIONAL MAN YRS	b. FUNDS (In thousands)
FISCAL YEAR PRECEDING: 79	2.5	112
FISCAL YEAR CURRENT: 80	6.4	160

19. RESPONSIBLE DOD ORGANIZATION
NAME: US Army Aeromedical Research Laboratory
ADDRESS: Fort Rucker, AL 36362

RESPONSIBLE INDIVIDUAL
NAME: KNAPP, S. C., COL, Cdr
TELEPHONE: (205) 255-5107

20. PERFORMING ORGANIZATION
NAME: US Army Aeromedical Research Lab Field Research & Biomedical Applications Division
ADDRESS: Fort Rucker, AL 36362

PRINCIPAL INVESTIGATOR (Furnish SSAN if U.S. Academic Institution)
NAME: CROSLEY, J. K., LTC, MSC
TELEPHONE (205) 255-3211
SOCIAL SECURITY ACCOUNT NUMBER

ASSOCIATE INVESTIGATORS
NAME: DUNCAN, C. E., MAJ, MSC
NAME: STROUD, J. P., 1LT, MSC

21. GENERAL USE
Foreign Intelligence Considered

22. KEYWORDS (Precede EACH with Security Classification Code): (U) Stress; (U) Biomedical Evaluation; (U) Aircraft; (U) Psychology; (U) Recording Devices; (U) Human Volunteers; (U) Aviation Medicine

23. TECHNICAL OBJECTIVE, 24. APPROACH, 25. PROGRESS (Furnish individual paragraphs identified by number. Precede text of each with Security Classification Code.)

23. (U) The objective of this project is to provide a definitive assessment of medical problems peculiar to the aviation environment and prepare guidelines for field commanders on the impact of these problems on the aviation mission. The results of such research will aid in development of improved standards and biomedical techniques for the field flight surgeon to use in monitoring and treating aviator stress and fatigue; as well as the medical standards for selection of aviators and air traffic controllers for specific assignments.

24. (U) A multidisciplinary approach, utilizing physiological measuring techniques, flight surgeon assessments, as well as aircraft comparisons, will provide the method to analyze aviator performance in the operational environment. Parameters to be measured will include heart rate, respiration, biochemical stress indices, and in-flight performance measurements.

25. (U) 7810-7909. Progress in this area of research has been demonstrated by the following accomplishments: A research protocol entitled "Aviator Stress Profile for the Cobra Helicopter" has been reviewed and approved by Scientific Review and Human Use Committees, USAARL and USAMRDC. Equipment to accomplish this work has been placed on order and a significant percentage of it has been received. A Cost Operational Effectiveness Analysis (COEA) is presently being conducted on the validity of present physical standards for Army aircrew and ATC personnel in relation to field requirements. Particular emphasis is being directed at the visual standards cited for aircrew personnel in AR 40-501.

*Available to contractors upon originator's approval

DD FORM 1 MAR 66 1498 PREVIOUS EDITIONS OF THIS FORM ARE OBSOLETE AND 498 1 MAR 66 FOR ARMY USE ARE OBSOLETE

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RESEARCH AND TECHNOLOGY WORK UNIT SUMMARY

1. AGENCY ACCESSION*	2. DATE OF SUMMARY*	REPORT CONTROL SYMBOL
	79 10 01	DD-DR&E(AR)636

3. DATE PREV SUMRY	4. KIND OF SUMMARY	5. SUMMARY SCTY*	6. WORK SECURITY*	7. REGRADING*	8a. DISP'N INSTR'N	8b. SPECIFIC DATA-CONTRACTOR ACCESS	9. LEVEL OF SUM
78 10 01	D. Change	(U)No Cls	U		NL	☒ YES ☐ NO	A. WORK UNIT

10. NO. CODES*	PROGRAM ELEMENT	PROJECT NUMBER	TASK AREA NUMBER	WORK UNIT NUMBER
a. PRIMARY	6.42.07.A	3E464207D425	00	048
b. CONTRIBUTING	6.11.01.A	3A161101A91C	00	288
c. CONTRIBUTING				

11. TITLE (Precede with Security Classification Code)* (U) Development of Measurement Techniques for the Medical Assessment of Visually Coupled System (VCS) Components

12. SCIENTIFIC AND TECHNOLOGICAL AREAS* 002400 Bioengineering; 007500 Human Factors Engineering; 001400 Aircraft Flight Instrumentation

13. START DATE	14. ESTIMATED COMPLETION DATE	15. FUNDING AGENCY	16. PERFORMANCE METHOD
75 09	CONT	DA	C. In-House

17. CONTRACT/GRANT
a. DATES/EFFECTIVE: NA — EXPIRATION:
b. NUMBER*:
c. TYPE: — d. AMOUNT:
e. KIND OF AWARD: — f. CUM. AMT.:

18. RESOURCES ESTIMATE	a. PROFESSIONAL MAN YRS	b. FUNDS (In thousands)
FISCAL YEAR — PRECEDING 79	1.0	65
FISCAL YEAR — CURRENT 80	1.0	80

19. RESPONSIBLE DOD ORGANIZATION
NAME:* US Army Aeromedical Research Laboratory
ADDRESS:* Fort Rucker, AL 36362

RESPONSIBLE INDIVIDUAL
NAME: Knapp, S. C., COL, Cdr
TELEPHONE: (205) 255 5407

20. PERFORMING ORGANIZATION
NAME:* US Army Aeromedical Research Lab Field Research & Biomedical Applications Division
ADDRESS:* Ft. Rucker, AL 36362

PRINCIPAL INVESTIGATOR (Furnish SSAN if U.S. Academic Institution)
NAME:* Verona, Robert W., CPT, SI
TELEPHONE: (205) 255 6415
SOCIAL SECURITY ACCOUNT NUMBER:

ASSOCIATE INVESTIGATORS
NAME: Crosley, J. K., LTC, MSC
NAME: Stone, L. W., MA, DAC

21. GENERAL USE
Foreign Intelligence Considered

22. KEYWORDS (Precede EACH with Security Classification Code)
(U) Visually coupled System; (U) Helmet Mounted Sight; (U) Helmet Mounted Display

23. TECHNICAL OBJECTIVE,* 24. APPROACH, 25. PROGRESS (Furnish individual paragraphs identified by number. Precede text of each with security Classification Code.)

23. (U) To develop measurement techniques for the medical assessment of Visually Coupled System (VCS) military components.

24. (U) It is possible to compromise an aviator's safety, physiological performance and his ability to fly when designing and fabricating a VCS. The VCS hardware must be scrutinized carefully to insure mutual man-machine conformity. The first phase of this study was concerned with the Helmet Mounted Sight (HMS) component of the VCS. The approach was to conduct a laboratory experiment to determine aiming and tracking capabilities of aviators using head orientation coupled trackers. The effects of eye dominance, helmet suspension, helmet weighting and target speed on accuracy were investigated. The second phase will be focused on the assessment of helmet mounted displays (HMD). Factors such as display color, image quality and size, brightness, contrast and their impact on the visual system of the crewmember and consequent performance will be investigated.

25. (U) 7810-7909. The Phase II airborne validation of the Phase I aiming/tracking data and quantitative medical assessment of a crewmember's pilotage and navigation performance using a VCS are just beginning. The UH-1M (INFANT) aircraft has been modified with a helmet sight, helmet display, flight symbology generator, position and location system, and aircraft parameter instrumentation system. The first VCS flights were accomplished and symbology and instrumental on calibration is progressing satisfactorily. A new lower persistance P-43 phosphor is being used in the helmet mounted display to minimize image smear. The minimum luminance required for daytime symbology viewing against various background levels has been measured at 570 footlamberts on the CRT face with 0° transmission optics. More data are being collected to quantify the display luminance and spectral luminance characteristics.

*Available to contractors upon originator's approval

DD FORM 1 MAR 68 1498 — PREVIOUS EDITIONS OF THIS FORM ARE OBSOLETE. DD FORMS 1498A AND 1498-1 1 MAR 68 FOR ARMY USE ARE OBSOLETE

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RESEARCH AND TECHNOLOGY WORK UNIT SUMMARY

1. AGENCY ACCESSION*	2. DATE OF SUMMARY*	REPORT CONTROL SYMBOL
	79 10 01	

3. DATE PREV SUM'RY	4. KIND OF SUMMARY	5. SUMMARY SCTY*	6. WORK SECURITY*	7. REGRADING*	8a. DISP'N INSTR'N	8b. SPECIFIC DATA (CONTRACTOR ONLY)*	9. LEVEL OF SUM
78 10 01	D. Change	U	U	NA	NL	YES / NO	A. WORK UNIT

10. NO. CODES*	PROGRAM ELEMENT	PROJECT NUMBER	TASK AREA NUMBER	WORK UNIT NUMBER
a. PRIMARY	6.1.07.A	4E162207D425	00	044
b. CONTRIBUTING				
c. CONTRIBUTING				

11. TITLE (Precede with Security Classification Code)*

(U) Aviator Workload Performance Assessment in Support of the Advanced Attack Helicopter

12. SCIENTIFIC AND TECHNOLOGICAL AREAS*

001300 Aircraft; 002400 Bioengineering; 009400 Man Machine Relations

13. START DATE	14. ESTIMATED COMPLETION DATE	15. FUNDING AGENCY	16. PERFORMING METHOD
78 10	CONT	DA	In-House

17. CONTRACT GRANT

a. DATES/EFFECTIVE: NA — EXPIRATION:
b. NUMBER*:
c. TYPE: — d. AMOUNT:
e. KIND OF AWARD: — f. CUM. AMT.:

18. RESOURCES ESTIMATE	A. PROFESSIONAL MAN-YEARS	B. MAN-MONTHS (Thousands)
FISCAL YEAR PRECEDING	2.0	0.4
FISCAL YEAR CURRENT	2.0	0.4

19. RESPONSIBLE DOD ORGANIZATION

NAME:* US Army Aeromedical Research Lab
ADDRESS:* Fort Rucker, AL 36362

RESPONSIBLE INDIVIDUAL
NAME: Knapp, S., C., COL, Cdr
TELEPHONE: (205) 255-6907

20. PERFORMING ORGANIZATION

NAME:* U.S. Army Aeromedical Research Lab
ADDRESS:* Fort Rucker, AL 36362

PRINCIPAL INVESTIGATOR (Individual responsible for the research effort)
NAME:* Spangler, G. E., LTC, MSC
TELEPHONE: (205) 255-6911
SOCIAL SECURITY ACCOUNT NUMBER:

ASSOCIATE INVESTIGATORS
NAME: [illegible], P. E., MSc
NAME: Scipione, R. R., MSc, DAC

21. GENERAL USE

Foreign Intelligence Considered

22. KEYWORDS (Precede EACH with Security Classification Code): (U) Military Aircraft; (U) Workload; (U) Aviator; (U) Man Machine Relations; (U) Bioengineering; (U) Psychology

23. TECHNICAL OBJECTIVE,* 24. APPROACH, 25. PROGRESS (Furnish individual paragraphs identified by number. Precede text of each with security classification code.)

23. (U) To investigate the physiological and psychological limits of human capability and compatibility with aviator crew stations, crew tasking and consequent cumulative crew workload, stress and fatigue in the YAH-64 and provide data which will point out areas of system design hampering mission effectiveness. To develop requirements for/participate in the product assessment of Visually Coupled System (VCS) components. To organize and assess aviator performance data with which to determine the best navigation equipment and procedures for AAH crewmembers. To provide AAH PM objective data on the personnel and [illegible] associated with the target detection, weapons selection, preparation and firing [illegible] with minimal visual and manual workload for successful mission performance.

24. (U) The approach will involve performance of a biomedical safety and human factors evaluation of the crew station configuration with respect to the cumulative workload [illegible] individual tasks on operator functions, specific operational systems and [illegible]. It will involve conducting laboratory and flight test research to determine the aiming tracking/flying capabilities of crewmembers using head orientation devices, VCS and helmet mounted displays (HMD) during high stress terrain helicopter flights and collect [illegible] pilot/gunner/navigator workload and performance data in usage of several different configurations of navigation instrumentation (i.e., Doppler System and [illegible]).

25. (U) 7810-7909. A symbology generator and an airborne electronic [illegible] have been fabricated to research HMD symbology luminance in flight in the YAH-64 helicopter. Data are being collected to optimize the optical combiner model for the IHADSS. A Doppler System was obtained and contracts let to lease a projected map [illegible] systems in a UH-1H instrumented research helicopter.

*Available to contractors upon originator's approval

DD FORM 1 MAR 68 1498 — PREVIOUS EDITIONS OF THIS FORM ARE OBSOLETE [illegible] AND 1498-1 1 MAR 68 FOR ARMY USE ARE OBSOLETE

RESEARCH AND TECHNOLOGY WORK UNIT SUMMARY

1. AGENCY ACCESSION	2. DATE OF SUMMARY	REPORT CONTROL SYMBOL
DA OD 6735	79 10 01	CSRA 1A(U)

3. DATE PREV SUMRY	4. KIND OF SUMMARY	5. SUMMARY SCTY	6. WORK SECURITY	7. REGRADING	8A. ORDER NUMBER	8B. SPECIFIC DATA (CONTRACT/GRANT)	9. LEVEL OF SUM
78 10 01	D. Change	U	1	NA		X YES NO	A. WORK UNIT

10. NO. CODES	PROGRAM ELEMENT	PROJECT NUMBER	TASK AREA NUMBER	WORK UNIT NUMBER
a. PRIMARY	6.27.73.A	3E162773A819	00	034
b. CONTRIBUTING				
c. CONTRIBUTING	CARDS 114 (D) (m)			

11. TITLE (Precede with Security Classification Code)

(U) Research of Bioengineering Problems Medically Significant to Army Aviation

12. SCIENTIFIC AND TECHNOLOGICAL AREAS

001300 Aircraft; 002400 Bioengineering; 023300 Protective Equipment

13. START DATE	14. ESTIMATED COMPLETION DATE	15. FUNDING AGENCY	16. PERFORMANCE METHOD
66 12	CONT	DA	C In House

17. CONTRACT GRANT

a. DATES/EFFECTIVE — EXPIRATION

b. NUMBER

c. TYPE — d. AMOUNT

e. KIND OF AWARD — f. CUM. AMT

18. RESOURCES ESTIMATE	a. PROFESSIONAL MAN YRS	b. FUNDS (In Thousands)
FISCAL YEAR PREVIOUS	79	5	159
FISCAL YEAR CURRENT	80	10.9	257

19. RESPONSIBLE DOD ORGANIZATION

NAME: US Army Aeromedical Research Lab

ADDRESS: Fort Rucker, AL 36362

RESPONSIBLE INDIVIDUAL

NAME: KNAPP, Stanley C., COL, Cdr

TELEPHONE: (205) 255 2813

20. PERFORMING ORGANIZATION

NAME: US Army Aeromedical Research Lab
Human Tolerance & Survivability Div

ADDRESS: Fort Rucker, AL 36362

PRINCIPAL INVESTIGATOR (Furnish SSAN if U.S. Academic Institution)

NAME: HALEY, J. L., Jr.

TELEPHONE: (205) 255 3001

SOCIAL SECURITY ACCOUNT NUMBER

ASSOCIATE INVESTIGATORS

NAME: SHANAHAN, D. F., CPT

NAME: APLAND, J. P., MAJ

21. GENERAL USE

Foreign Intelligence Considered

22. KEYWORDS (Precede EACH with Security Classification Code) (U) Helmet Testing; (U) Injury Prevention; (U) Protective Equipment; (U) Burn Prevention; (U) Porcine Burns; (U) Head Protection; (U) Bioengineer

23. TECHNICAL OBJECTIVE, 24. APPROACH, 25. PROGRESS (Furnish individual paragraphs identified by number. Precede text of each with Security Classification Code.)

23. (U) To provide valid, meaningful biomedical criteria for the development of improved designs and equipment for head protection, the means to assess helmet protective performance, and prevention of posterash fire burn by improved thermal protective clothing.

24. (U) The approach will be based on sound and accepted experiment bioengineering methodologies including mathematical modeling, pathophysiologic techniques, biomechanics, structural engineering, thermodynamics, and physics.

25. (U) 7810-7909. This work unit supports the Army's designated responsibility for direct head impact work for all three services. Charged to establish a biologically valid helmet impact test methodology. A major effort has begun to improve head protection in military aircraft accidents because one out of three aircraft crash fatalities is a result of head and/or neck trauma. In FY 79, the following tasks were completed: (1) a continuation research contract was consummated to complete the research on an energy absorbing earcup to attenuate impacts in the tempro parietal region of the head, (2) a draft Flight Helmet Performance Specification was written, but validation of the shell toughness criteria and retention harness criteria must be completed prior to release of this document, (3) a final contract to complete the last phase of the thermal math model for thermal protective clothing performance was initiated, (4) a tri-service contract to evaluate the UH 60 Blackhawk crew and troop seat energy-absorbing characteristics with cadaver occupants was initiated, and (5) an Army Navy agreement to provide multi-axis impact tolerance criteria via research with Navy volunteers was also initiated. Manuscript entitled "The Use of Mathematical Modeling in Crashworthy Helicopter Seating Systems" was presented at AGARD, Paris, France.

*Available to contractors upon originator's approval

DD FORM 1 MAR 66 1498 PREVIOUS EDITIONS OF THIS FORM ARE OBSOLETE. DD FORMS 1498A NOV 68 AND 1498 1 MAR 68 (FOR ARMY USE) ARE OBSOLETE

RESEARCH AND TECHNOLOGY WORK UNIT SUMMARY

1. AGENCY ACCESSION	2. DATE OF SUMMARY	REPORT CONTROL SYMBOL
DAOG 0162	79 10 01	DD-DR&E AR-636

3. DATE PREV SUM'RY	4. KIND OF SUMMARY	5. SUMMARY SCTY	6. WORK SECURITY	7. REGRADING	8a. DISP'N INSTR'N	8b. SPECIFIC DATA CONTRACTOR ACCESS	9. LEVEL OF SUM
78 10 01	D. CHANGE	U	U	NA	XL	☒ YES ☐ NO	A. WORK UNIT

10. NO. CODES	PROGRAM ELEMENT	PROJECT NUMBER	TASK AREA NUMBER	WORK UNIT NUMBER
a. PRIMARY	6.27.73.A	3E162773A819	00	005
b. CONTRIBUTING				
c. CONTRIBUTING				

11. TITLE (Precede with Security Classification Code)

(U) Direct Field Support to Immediate Army Aeromedical and Ground Vehicle Problems

12. SCIENTIFIC AND TECHNOLOGICAL AREAS

016200 Stress Physiology; 002400 Bioengineering; 08800 Life Support

13. START DATE	14. ESTIMATED COMPLETION DATE	15. FUNDING AGENCY	16. PERFORMANCE METHOD
78 10	CONT	DA	C. In House

17. CONTRACT GRANT

a. DATES/EFFECTIVE: NA — EXPIRATION:
b. NUMBER:
c. TYPE: — d. AMOUNT:
e. KIND OF AWARD: — f. CUM. AMT.:

18. RESOURCES ESTIMATE	a. PROFESSIONAL MAN YRS	b. FUNDS (In thousands)
FISCAL YEAR PRECEDING 79	2.0	93
FISCAL YEAR CURRENT 80	3.4	98

19. RESPONSIBLE DOD ORGANIZATION

NAME: US Army Aeromedical Research Laboratory
ADDRESS: Fort Rucker, AL 36362

RESPONSIBLE INDIVIDUAL
NAME: Knapp, S.C., COL, Cdr
TELEPHONE: (205) 255-6167

20. PERFORMING ORGANIZATION

NAME: US Army Aeromedical Research Lab
Field Research and Biomedical Applications Division
ADDRESS: Fort Rucker, AL 36362

PRINCIPAL INVESTIGATOR (Furnish SSAN if it is also the institution)
NAME: Armstrong, G. [illegible], PSC
TELEPHONE: (205) 255-[illegible]
SOCIAL SECURITY ACCOUNT NUMBER:

ASSOCIATE INVESTIGATORS
NAME: Stroud, [illegible], H.I., MSC
NAME: Hundley, J. A., BS, DAC

21. GENERAL USE

Foreign Intelligence Considered

22. KEYWORDS (Precede EACH with Security Classification Code): (U) Protective Equipment; (U) Stress Physiology; (U) Biomedical Engineering; (U) Man Machine Relationships; (U) Biochemistry; (U) Life Support

23. TECHNICAL OBJECTIVE 24. APPROACH. 25. PROGRESS (Furnish individual paragraphs identified by number. Precede text of each with Security Classification Code.)

23. (U) To provide biomedically pertinent information and solutions to [illegible] operational field problems in areas related to the interface of the physical [illegible] aspects of aviation and ground vehicles including evaluation of concepts, prototypes and first article equipment and systems.

24. (U) The application of physiological and medical evaluative techniques, prior research data, and user questionnaires to assess, enhance, and validate equipment and systems proposed to resolve immediate medically related field problems. It will involve laboratory dynamic impact and acoustic noise attenuation test of helmets, field assessments of protective clothing, simulated and field investigations of vehicle seat configurations, flight testing of the medical aspects of rescue equipment and the evaluating, verification, downwash and crashworthiness.

25. (U) 7810-7909. Laboratory dynamic impact evaluation tests were conducted on two production lots of aviator flight helmets and two production lots of the combat vehicle crewman helmets to determine if they meet required medical criteria. Consultation was provided to the material developer to improve helmet protective qualities. Tests were conducted to validate the impact protection effectiveness of the HGU-2 form fitted flight helmet to be utilized in the YAH-64 development program. First article evaluation and testing was conducted on two flight helmets produced by two new manufacturers. An operational evaluation of a new aviators' flight glove was completed. A field investigation of the seat configuration of the modified scout helicopter (OH-58C) was completed and recommendations provided to reduce the medical hazards associated with the crewstation of the OH-58C.

*Available to contractors upon originator's approval

DD, FORM 1498 MAR 68 — PREVIOUS EDITIONS OF THIS FORM ARE OBSOLETE [illegible] FORMS 1498A [illegible] AND 1498-1, 1 MAR 68, FOR ARMY USE ARE OBSOLETE

RESEARCH AND TECHNOLOGY WORK UNIT SUMMARY

1. AGENCY ACCESSION	2. DATE OF SUMMARY	REPORT CONTROL SYMBOL
DA OG 0167	79 10 01	DD-DR&E(AR)636

3. DATE PREV SUM'RY	4. KIND OF SUMMARY	5. SUMMARY SCTY	6. WORK SECURITY	7. REGRADING	8A. DISP'N INSTR'N	8B. SPECIFIC DATA-CONTRACTOR ACCESS	9. LEVEL OF SUM
78 10 01	D. Change	U	U	NA	NL	☒ YES ☐ NO	A. WORK UNIT

10. NO./CODES	PROGRAM ELEMENT	PROJECT NUMBER	TASK AREA NUMBER	WORK UNIT NUMBER
a. PRIMARY	6.27.73.A	3E162773A819	00	013
b. CONTRIBUTING				
c. CONTRIBUTING				

11. TITLE (Precede with Security Classification Code)

(U) Life Support Equipment Retrieval Program

12. SCIENTIFIC AND TECHNOLOGICAL AREAS

008800 Life Support; 016200 Stress Physiology; 002400 Bioengineering

13. START DATE	14. ESTIMATED COMPLETION DATE	15. FUNDING AGENCY	16. PERFORMANCE METHOD
78 10	CONT	DA	C. In-House

17. CONTRACT/GRANT

a. DATES/EFFECTIVE: N/A — EXPIRATION:
b. NUMBER:
c. TYPE: — d. AMOUNT:
e. KIND OF AWARD: — f. CUM. AMT.

18. RESOURCES ESTIMATE		a. PROFESSIONAL MAN YRS	b. FUNDS (In thousands)
FISCAL YEAR	PREVIOUS 79	3.5	159
	CURRENT 80	5.8	158

19. RESPONSIBLE DOD ORGANIZATION

NAME: US Army Aeromedical Research Laboratory

ADDRESS:

RESPONSIBLE INDIVIDUAL

NAME: Knapp, S. C., COL, Cdr
TELEPHONE: (205) 255 5107

20. PERFORMING ORGANIZATION

NAME: US Army Aeromedical Research Lab
Field Research and Biomedical Applications Division

ADDRESS: Fort Rucker, AL 36362

PRINCIPAL INVESTIGATOR (Furnish SSAN if U.S. Academic Institution)

NAME: Hundley, T. A., BA, DAC
TELEPHONE: (205) 255 3211
SOCIAL SECURITY ACCOUNT NUMBER

ASSOCIATE INVESTIGATORS

NAME: Johnson, G. L., SSG
NAME: Armstrong, R. N., MS, DAC

21. GENERAL USE

Foreign Intelligence Considered

22. KEYWORDS (Precede EACH with Security Classification Code)

(U) Protective Equipment; (U) Stress Physiology; (U) Musculoskeletal Systems; (U) Biomedical; (U) Man Machine Relationships

23. TECHNICAL OBJECTIVE. 24. APPROACH. 25. PROGRESS (Furnish individual paragraphs identified by number. Precede text of each with Security Classification Code.)

23. (U) To provide a technological data base concerning the physiological and biomedical aspects of the evaluation and injury correlation of life support equipment, identification of hazard protection problems associated with life support equipment and to provide conceptual design recommendations and criteria for the improvement of life support equipment.

24. (U) Army aviation life support equipment involved in either injury causation or prevention, in the field, are sent to USAARL for biomedical and injury correlation evaluation. This evaluation assesses the effectiveness/deficiencies of the life support equipment through an analysis of the physical condition of the protective devices, the human injury incurred and the related human dynamics involved in the accident. The analysis is accomplished by the application of epidemiologic methods incorporating medically related engineering failure mode analysis, accident investigative procedures, forensic pathology, mathematical modeling and applied bioengineering research techniques.

25. (U) 7810-7909. A biomedical/physiological crash injury computerized data base and associated retrieval programs were established and helmet injury correlation data collected. Consultations were provided to the US Army Safety Center concerning the life support equipment aspects of accident investigations and injury prevention. During FY 79, the LSERP received 35 prams concerning major accidents. None of the accidents met the criteria for initiating case studies. The life support equipment recovered from these accidents included 21 flight helmets, 4 seats, and a number of seat belts and articles of clothing. A backlog of 36 cases were evaluated and closed out. Letters of agreement concerning exchange and evaluation of retrieved LSE were signed with the Air Force and the Navy. Defects in helmet retention system replacement parts were discovered and brought to the attention of the procuring agency.

*Available to contractors upon originator's approval

DD, FORM 1498 (MAR 68) PREVIOUS EDITIONS OF THIS FORM ARE OBSOLETE. DD FORMS 1498A (NOV 65) AND 1498-1 (MAR 68) (FOR ARMY USE) ARE OBSOLETE

RESEARCH AND TECHNOLOGY WORK UNIT SUMMARY

1. AGENCY ACCESSION	2. DATE OF SUMMARY	REPORT CONTROL SYMBOL
DA OG 0165	79 10 01	DD-DR&E(AR)636

3. DATE PREV SUM'RY	4. KIND OF SUMMARY	5. SUMMARY SCTY	6. WORK SECURITY	7. REGRADING	8. DISP'N INSTR'N	8b. SPECIFIC DATA-CONTRACTOR ACCESS	9. LEVEL OF SUM
78 10 01	D. CHANGE	U	U	NA	NL	☒ YES ☐ NO	A. WORK UNIT

10. NO./CODES:	PROGRAM ELEMENT	PROJECT NUMBER	TASK AREA NUMBER	WORK UNIT NUMBER
a. PRIMARY	6.27.73.A	3E162773A819	00	014
b. CONTRIBUTING				
c. CONTRIBUTING				

11. TITLE (Procede with Security Classification Code)

(U) Research Countermeasures for Significant Medical Hazards in Military Systems

12. SCIENTIFIC AND TECHNOLOGICAL AREAS 006000 Escape, Rescue & Survivability; 002400 Bioengineering; 016200 Stress Physiology

13. START DATE	14. ESTIMATED COMPLETION DATE	15. FUNDING AGENCY	16. PERFORMANCE METHOD
78 10	CONT	DA	C. In-House

17. CONTRACT/GRANT

a. DATES/EFFECTIVE: NA EXPIRATION:

b. NUMBER:

c. TYPE: d. AMOUNT:

e. KIND OF AWARD: f. CUM. AMT.

18. RESOURCES ESTIMATE	a. PROFESSIONAL MAN YRS	b. FUNDS (In thousands)
FISCAL YEAR PRECEDING 79	4.3	179
FISCAL YEAR CURRENT 80	2.4	164

19. RESPONSIBLE DOD ORGANIZATION

NAME: US Army Aeromedical Research Laboratory

ADDRESS: Fort Rucker, AL 36362

RESPONSIBLE INDIVIDUAL

NAME: Knapp, S. C., COL, Cdr

TELEPHONE: (205) 255-5107

20. PERFORMING ORGANIZATION

NAME: US Army Aeromedical Research Laboratory

ADDRESS: Field Research & Biomedical Applications Division, Ft Rucker, AL 36362

PRINCIPAL INVESTIGATOR (Furnish SSAN if U.S. Academic Institution)

NAME: Armstrong, R. N., MS, DAC

TELEPHONE: (205) 255-3211

SOCIAL SECURITY ACCOUNT NUMBER

ASSOCIATE INVESTIGATORS

NAME: Hundley, T. A., BA, DAC

NAME: Nagel, G. A., CPT, MSC

21. GENERAL USE

Foreign Intelligence Considered

22. KEYWORDS (Procede EACH with Security Classification Code) (U) Hazards; (U) Protective Equipment; (U) Stress Physiology; (U) Life Support; (U) Bioengineering; (U) Biochemistry

23. TECHNICAL OBJECTIVE. 24. APPROACH. 25. PROGRESS (Furnish individual paragraphs identified by number. Procede text of each with Security Classification Code.)

23. (U) Conduct applied medical research to identify, assess and prevent unnecessary health hazards and personnel injuries imposed by exposure to the operational environment (altitude pressures, heat, cold, noise, toxic gases, oxygen levels, overblast pressures, chemical and biological agents, vibration, acceleration and deceleration impacts), and to provide the Army technical information, recommendations and standards to be used in the development and modification of systems that provide protection from those hazards.

24. (U) The approach involves the application of physiological and biomedical applied research methods utilizing physical and anthropometric examinations, x-rays, biochemistry, EMG muscle stress measurement and dynamic impact analysis techniques to isolate the hazards involved and determine required protective measures. These techniques will be applied to the establishment of biomedical requirements of orthopedically designed seat configurations, head impact protection, vehicle crashworthiness, body restraint systems, environmental control systems, oxygen generating systems, life support survival equipment and aeromedical evacuation and rescue equipment.

25. (U) 7810-7909. The data collection phase of the acceleration/deceleration impact hazard assessment of ground combat vehicles was completed and the data analysis phase initiated. Preliminary medical criteria have been established for the development of the new combat vehicle crewman protective helmet. Efforts have been initiated toward the establishment of impact test criteria and methodology for the CVC helmet. The initial field assessment for the concept evaluation of the United Kingdom NVC protective clothing was conducted under aviation operational conditions. The general methodology has been established for further assessment of the medical hazards and operational constraints associated with the use of NBC protective clothing to be conducted during FY 80.

*Available to contributors upon originator's approval

DD FORM 1 MAR 66 1498 PREVIOUS EDITIONS OF THIS FORM ARE OBSOLETE AND 1498 1 MAR 65 FOR ARMY USE ARE OBSOLETE

RESEARCH AND TECHNOLOGY WORK UNIT SUMMARY

1. AGENCY ACCESSION	2. DATE OF SUMMARY	REPORT CONTROL SYMBOL
DA OG 0169	79 09 30	DD DR&E(AR)636

3. DATE PREV SUM'RY	4. KIND OF SUMMARY	5. SUMMARY SCTY	6. WORK SECURITY	7. REGRADING	8a. DISP'N INSTR'N	8b. SPECIFIC DATA - CONTRACTOR ACCESS	9. LEVEL OF SUM
79 04 25	D. CHANGE	U	U	NA	NL	☒ YES ☐ NO	A. WORK UNIT

10. NO. CODES	PROGRAM ELEMENT	PROJECT NUMBER	TASK AREA NUMBER	WORK UNIT NUMBER
a. PRIMARY	6.27.73.A	3E162773A819	00	047
b. CONTRIBUTING				
c. CONTRIBUTING				

11. TITLE (Precede with Security Classification Code): (U) Biomedical Application & Health Hazard Assessment of Oxygen Enrichment Breathing Systems

12. SCIENTIFIC AND TECHNOLOGICAL AREAS: 016200 Stress Physiology; 008800 Life Support; 001300 Aircraft

13. START DATE	14. ESTIMATED COMPLETION DATE	15. FUNDING AGENCY	16. PERFORMANCE METHOD
79 05	80 09	DA	C. In-House

17. CONTRACT GRANT
a. DATES/EFFECTIVE
EXPIRATION
b. NUMBER
c. TYPE
d. AMOUNT
e. KIND OF AWARD
f. CUM. AMT.

18. RESOURCES ESTIMATE		a. PROFESSIONAL MAN YRS	b. FUNDS (In thousands)
FISCAL YEAR	PRECEDING 79	1.5	55
	CURRENT 80	2.0	69

19. RESPONSIBLE DOD ORGANIZATION
NAME: US Army Aeromedical Research Laboratory
ADDRESS: Fort Rucker, AL 36362
RESPONSIBLE INDIVIDUAL
NAME: Knapp, S. C., COL, Cdr
TELEPHONE: (205) 255-5107

20. PERFORMING ORGANIZATION
NAME: US Army Aeromedical Research Laboratory
ADDRESS: Field Research & Biomedical Applications Division, Ft Rucker, AL 36362
PRINCIPAL INVESTIGATOR (Furnish SSAN if U.S. Academic Institution)
NAME: Armstrong, R. N., MS, DAC
TELEPHONE: (205) 255-3211
SOCIAL SECURITY ACCOUNT NUMBER
ASSOCIATE INVESTIGATORS
NAME: Hiott, B. F., TSGT
NAME: Kessler, J. B., CPT, MC

21. GENERAL USE: Foreign Intelligence Considered

22. KEYWORDS (Precede EACH with Security Classification Code): (U) Oxygen Supply Equipment; (U) Life Support; (U) Stress Physiology; (U) Aircraft; (U) Toxicology

23. TECHNICAL OBJECTIVE. 24. APPROACH. 25. PROGRESS (Furnish individual paragraphs identified by number. Precede text of each with Security Classification Code.)

23. (U) To identify, assess, and prevent unnecessary health hazards associated with the flight environment and to obtain a biomedical data base on the human function associated with the use of aircraft oxygen enrichment breathing systems in the flight environment. To provide the Army data, information, recommendations and criteria to aid in the development and deployment of life support systems to alleviate identified health hazards.

24. (U) The approach will consist of a biomedical evaluation of state-of-the-art oxygen enrichment breathing systems during aircraft ground and flight conditions. The evaluation will include the sampling of the environmental air input to the system as well as the system output enriched air. The samples will be analyzed to determine the systems' ability to effectively filter contaminates known to exist in the operational environment. Physiological data, heart rate, oxygen tension and respiratory functions as well as system parameters, oxygen concentration, flow rates, temperatures and pressures will be collected during ground operations and aircraft flight at altitude to assess the ability of the system to provide aviators the required oxygen concentration and purity during various flight profiles. The data collected will be evaluated with respect to biomedical, safety, and man/machine limitations.

25. (U) 7810-7909. Two state-of-the-art molecular sieve oxygen generating systems, associated transducers, and physiological measurement systems have been acquired. Preliminary aircraft (U-21 and UH-1) bleed air environmental and gas analysis assessments have been conducted. Static and in-flight environmental data collection systems have been designed and initial tests conducted. Calibration and validation of the arterial blood oxyhemoglobin saturation assessment system have been conducted utilizing canine subjects. Altitude chamber static and flight tests are scheduled to begin the first quarter of FY 80. (Investigator's approval)

DD FORM 1498

RESEARCH AND TECHNOLOGY WORK UNIT SUMMARY

1. AGENCY ACCESSION	2. DATE OF SUMMARY	REPORT CONTROL SYMBOL
DA OB 6895	79 10	DD DR&E(AR)636

3. DATE PREV SUM'RY	4. KIND OF SUMMARY	5. SUMMARY SCTY	6. WORK SECURITY	7. REGRADING	8A. DISP'N INSTR'N	8b. SPECIFIC DATA CONTRACTOR ACCESS	9. LEVEL OF SUM
78 10 01	D. Change	U	U	NA	NL	☒ YES ☐ NO	A. WORK UNIT

10. NO./CODES:	PROGRAM ELEMENT	PROJECT NUMBER	TASK AREA NUMBER	WORK UNIT NUMBER
a. PRIMARY	6.27.73.A	3E162773A819	00	007
b. CONTRIBUTING				
c. [illegible]	CARDS 114	(f) (m)		

11. TITLE (Precede with Security Classification Code): (U) Aeromedical and Physiological Research for Aircrew Selection, Retention, and Biomedical Tolerance Standards.

12. SCIENTIFIC AND TECHNOLOGICAL AREAS: 001300 Aircraft; 012900 Physiology; 016200 Stress Physiology; 002300 Biochemistry; 012400 Personnel Selection & Maintenance; 009400 Man Machine Relation

13. START DATE	14. ESTIMATED COMPLETION DATE	15. FUNDING AGENCY	16. PERFORMANCE METHOD
76 10	CONT	DA	C. In-House

17. CONTRACT/GRANT
a. DATES/EFFECTIVE: EXPIRATION
b. NUMBER:
c. TYPE: d. AMOUNT:
e. KIND OF AWARD: f. CUM. AMT.

18. RESOURCES ESTIMATE	a. PROFESSIONAL MAN YRS	b. FUNDS (In thousands)
FISCAL YEAR PRECEDING 79	5.8	206
FISCAL YEAR CURRENT 80	12.7	400

19. RESPONSIBLE DOD ORGANIZATION
NAME: US Army Aeromedical Research Laboratory
ADDRESS: Ft. Rucker, AL 36362

RESPONSIBLE INDIVIDUAL
NAME: Knapp, Stanley C., COL, CDR
TELEPHONE: (205) 255-5107

20. PERFORMING ORGANIZATION
NAME: US Army Aeromedical Research Lab
Human Tolerance & Survivability Div
ADDRESS: Ft. Rucker, AL 36362

PRINCIPAL INVESTIGATOR (Furnish SSAN if U.S. Academic Institution)
NAME: Harding, T. H., CPT
TELEPHONE: (205) 255-5114
SOCIAL SECURITY ACCOUNT NUMBER
ASSOCIATE INVESTIGATORS
NAME
NAME

21. GENERAL USE
Foreign Intelligence Considered

22. KEYWORDS (Precede EACH with Security Classification Code): (U) Aircraft; (U) Pulmonary Physiology; (U) Stress Physiology; (U) Pharmacology; (U) Life Support

23. TECHNICAL OBJECTIVE, 24. APPROACH, 25. PROGRESS (Furnish individual paragraphs identified by number. Precede text of each with Security Classification Code.)

23. (U) To determine biomedical tolerance standards for military environments and requirements and to relate these standards to aircrew selection and retention medical criteria.

24. (U) The approach will include accepted medical, physiological, neurophysiological, and audiological quantitative techniques, using both human volunteers and animal models where appropriate.

25. (U) 7810 7909. During this past year, A neurophysiology laboratory and a respiratory physiology laboratory have been established and staffed. The following research protocols have been submitted and are at differing stages of active investigation: Cardiopulmonary Physiology in Army Aviators, Acquisition of Speech Discrimination Testing Materials for Aviators, and Attenuation Variation Obtained with Training when Utilizing an In the Ear Hearing Protective Devices. In addition to these established protocols, two protocols involving retinal neurophysiology are presently being developed. An active program involving evaluation of various techniques of blood gas analysis during hypobaric hearing completion using animal models. Progress is shown in USAARL Report 79-10, Real Ear Sound Attenuation Measurements of Bilsom Propp-O-Plast Disposable Hearing Protective Devices; USAARL Report 79-7, Normal Blood Chemistry Values for Laboratory Animals Analyzed by the Sequential Multiple Channel Analyzer Computer (SMAC); USAARL LR 79-10-2-4, Real Ear Attenuation Measurements of Selected Sound Protective [illegible] in the DAE Qualified Products List; and USAARL LR 79-4-2-1, Preliminary [illegible] the Hewlett Packard Ear Oximeter in Army Aircraft.

*Available to contractors upon originator's approval

DD FORM 1498 [illegible]

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RESEARCH AND TECHNOLOGY WORK UNIT SUMMARY

1. AGENCY ACCESSION	2. DATE OF SUMMARY	REPORT CONTROL SYMBOL
	79 10 01	DD DR&E(AR)636

3. DATE PREV SUM'RY	4. KIND OF SUMMARY	5. SUMMARY SCTY	6. WORK SECURITY	7. REGRADING	8a. DISP'N INSTR'N	8b. SPECIFIC DATA - CONTRACTOR ACCESS	9. LEVEL OF SUM
79 04 25	D. Change	U	U	NA	NL	☒ YES ☐ NO	A. WORK UNIT

10. NO. CODES	PROGRAM ELEMENT	PROJECT NUMBER	TASK AREA NUMBER	WORK UNIT NUMBER
a. PRIMARY	6.26.01	IL162601AH91		
b. CONTRIBUTING	6.27.73.A	3E162773A819	00	046
c. CONTRIBUTING				

11. TITLE (Precede with Security Classification Code): (U) Health Hazard Assessment and Implications of Whole-Body Vibration Associated with Advanced Combat Vehicle Technologies

12. SCIENTIFIC AND TECHNOLOGICAL AREAS: 007500 Human Factors Engineering; 009400 Man-Machine Relations; 012900 Physiology; 008800 Life Support

13. START DATE	14. ESTIMATED COMPLETION DATE	15. FUNDING AGENCY	16. PERFORMANCE METHOD
79 06	80 12	DA	C. In House

17. CONTRACT/GRANT
a. DATES/EFFECTIVE: NA — EXPIRATION:
b. NUMBER:
c. TYPE: — d. AMOUNT:
e. KIND OF AWARD: — f. CUM. AMT.

18. RESOURCES ESTIMATE	a. PROFESSIONAL MAN YRS	b. FUNDS (In thousands)
FISCAL YEAR PRECEDING: 79	1.5	45
FISCAL YEAR CURRENT: 80	1.0	55

19. RESPONSIBLE DOD ORGANIZATION
NAME: US Army Aeromedical Research Lab
ADDRESS: Fort Rucker, AL 36362

RESPONSIBLE INDIVIDUAL
NAME: KNAPP, S. C., COL, Cdr
TELEPHONE: (205) 255-5107

20. PERFORMING ORGANIZATION
NAME: US Army Aeromedical Research Lab
ADDRESS: Field Research & Biomedical Applications Division
Fort Rucker, AL 36362

PRINCIPAL INVESTIGATOR (Furnish SSAN if U.S. Academic Institution)
NAME: JOHNSON, J. C., CPT, MSC
TELEPHONE: (205) 255 3211
SOCIAL SECURITY ACCOUNT NUMBER

ASSOCIATE INVESTIGATORS
NAME: BEHAR, I., Ph.D.; BURDICK, C., CPT
NAME: MOZO, B. T., DAC

21. GENERAL USE
Foreign Intelligence Considered

22. KEYWORDS (Precede EACH with Security Classification Code): (U) Vibration; (U) Noise; (U) Vestibular; (U) Bioengineering; (U) Acuity; (U) Stress; (U) Biodynamics; (U) Simulation

23. TECHNICAL OBJECTIVE. 24. APPROACH. 25. PROGRESS (Furnish individual paragraphs identified by number. Precede text of each with Security Classification Code.)

23. (U) To assess the effect of whole-body, low frequency vibration and noise peculiar to advanced combat vehicles on the human visual, vestibular, hearing, and musculoskeletal systems. Correlate these effects in relations to their relative hazards to acute or chronic injury potential and influence on crew performance, comfort, and efficiency. Develop health criteria recommendations for vehicle and subsystem design and operation.

24. (U) The approach will be multidisciplinary in nature. Dynamic characteristics of the High Survivability Test Vehicle-Light (HSTV-L) semisupine seat will be determined by Fourier transform techniques using instrumented human subjects on the USAARL multiaxis vibration table. Stress and fatigue reactions including neck muscle stress and fatigue associated with operation of video displays, target acquisition system, and head coupled vibration will be assessed by standard biochemical and psychophysiologic as well as specialized electromyographic techniques. Dynamic visual acuity and eye fatigue will be studied under multiple conditions of target display, head and eye movement, and frequency phase controlled vibration, contrast, and luminance.

25. (U) 7904 7909. Instrumentation for the determination of human response to vibration is being acquired, installed, and calibrated. The vibration data acquisition system will provide information that can be used to validate or expand the scope of human vibration models developed for other seating arrangements. Specifications for a computer driven device for dynamic visual acuity measurement using a video display have been written. Coordination of data processing has been initiated with the USAARL computer facility. A two channel audiometer has been ordered to monitor vibration induced hearing threshold effects which may appear.

*Available to contractors upon originator's approval

DD FORM 1 MAR 68 1498 — PREVIOUS EDITIONS OF THIS FORM ARE OBSOLETE ... AND 1498-1 1 MAR 68 FOR ARMY USE ARE OBSOLETE

RESEARCH AND TECHNOLOGY WORK UNIT SUMMARY	1. AGENCY ACCESSION* DAOG 0161	2. DATE OF SUMMARY* 79 10 01	REPORT CONTROL SYMBOL DD-DR&E(AR)636

3. DATE PREV SUM'RY	4. KIND OF SUMMARY	5. SUMMARY SCTY*	6. WORK SECURITY*	7. REGRADING*	8a. DISB'N INSTR'N	8b. SPECIFIC DATA-CONTRACTOR ACCESS	9. LEVEL OF SUM
78 10 01	H. Term	U	U	NA	NL	[X] YES [ ] NO	A. WORK UNIT

10. NO./CODES:*	PROGRAM ELEMENT	PROJECT NUMBER	TASK AREA NUMBER	WORK UNIT NUMBER
a. PRIMARY	6.27.73.A	3E162773A819	00	011
b. CONTRIBUTING				
c. CONTRIBUTING				

11. TITLE (Precede with Security Classification Code)*
(U) Biomedical Research in Support of Advancing Military Operations

12. SCIENTIFIC AND TECHNOLOGICAL AREAS*
009400 Man-Machine Relations; 002400 Bioengineering; 013400 Psychology

13. START DATE	14. ESTIMATED COMPLETION DATE	15. FUNDING AGENCY	16. PERFORMANCE METHOD
78 10	CONT	DA	C. In-House

17. CONTRACT/GRANT
a. DATES/EFFECTIVE: NA EXPIRATION:
b. NUMBER:*
c. TYPE: d. AMOUNT:
e. KIND OF AWARD: f. CUM. AMT.

18. RESOURCES ESTIMATE		a. PROFESSIONAL MAN YRS	b. FUNDS (In thousands)
FISCAL YEAR	PRECEDING 79	1.5	68
	CURRENT 80	0	0

19. RESPONSIBLE DOD ORGANIZATION
NAME:* US Army Aeromedical Research Laboratory
ADDRESS:* Fort Rucker, AL 36362
RESPONSIBLE INDIVIDUAL
NAME: Knapp, S. C., COL, Cdr
TELEPHONE: (205) 255-5107

20. PERFORMING ORGANIZATION
NAME:* US Army Aeromedical Research Lab
ADDRESS:* Field Research and Biomedical Applications Division
Fort Rucker, AL 36362
PRINCIPAL INVESTIGATOR (Furnish SSAN if U.S. Academic Institution)
NAME:* Krueger, G. P., MAJ, MSC
TELEPHONE: (205) 255-3211
SOCIAL SECURITY ACCOUNT NUMBER
ASSOCIATE INVESTIGATORS
NAME: Chiou, W. C., Ph.D., DAC
NAME: Cisco, R. R., SSG,

21. GENERAL USE
Foreign Intelligence Considered

22. KEYWORDS (Precede EACH with Security Classification Code)
(U) Air-to-Air Helicopter Combat; (U) Aviator Stress; (U) Advanced Aviation Tactics

23. TECHNICAL OBJECTIVE,* 24. APPROACH, 25. PROGRESS (Furnish individual paragraphs identified by number. Precede text of each with Security Classification Code.)

23. (U) To perform applied medical research on the biomedical and biobehavioral aspects of advanced combat tactics, equipment systems and military operations. To investigate and determine the psychological, biophysical and physiological parameters affecting the aviator in target detection and engagement during helicopter air-to-air combat operations. To assess aviator workload and performance in the utilization of integrated flight displays for advanced development aircraft systems and conceptual display advances for aviator night vision goggles.

24. (U) The approach will involve the collection of psychological and physiological data in the identification and assessment of pilot performance and stress variables during air-to-air combat maneuvers conducted during the Army and Air Force Tactics Development and Evaluation of Joint-Countering Attack Helicopter (J-CATCH) operations. It will involve the conduct of experiments in an instrumented helicopter research flight simulator to determine the effectiveness and anticipated changes to pilot work load in the utilization of integrated flight displays. It will also include the conduct of in flight experimentation to determine the visual and biomedical implications of adding flight display information to night vision goggles.

25. (U) 7810 7909. A joint USAARL and Aviation Board presentation on helicopter pilot visual detection problems in terrain flight air-to-air combat was made to the National Research Council committee on vision. A concept evaluation project (CE) was conducted to determine the military potential and operational effectiveness of displaying helicopter digital instrumentation data into AN/PVS-5 night vision goggles for use by pilots in flight. Due to departure of key personnel and lack of necessary funding to perpetuate this research effort, this work unit is terminated.

*Available to contractors upon originator's approval

DD FORM 1498, 1 MAR 68 — PREVIOUS EDITIONS OF THIS FORM ARE OBSOLETE. DD FORMS 1498A, 1 NOV 65 AND 1498-1, 1 MAR 68 (FOR ARMY USE) ARE OBSOLETE

RESEARCH AND TECHNOLOGY WORK UNIT SUMMARY

1. AGENCY ACCESSION	2. DATE OF SUMMARY	REPORT CONTROL SYMBOL
DA OG 0158	79 10 01	DD-DR&E(AR)636

3. DATE PREV SUM'RY	4. KIND OF SUMMARY	5. SUMMARY SCTY	6. WORK SECURITY	7. REGRADING	8a. DISP'N INSTR'N	8b. SPECIFIC DATA-CONTRACTOR ACCESS	9. LEVEL OF SUM
78 10 01	H. TERM	U	U	NA	NL	☒ YES ☐ NO	A. WORK UNIT

10. NO./CODES:	PROGRAM ELEMENT	PROJECT NUMBER	TASK AREA NUMBER	WORK UNIT NUMBER
a. PRIMARY	6.27.73.A	3E162773A819	00	012
b. CONTRIBUTING				
c. CONTRIBUTING				

11. TITLE (Precede with Security Classification Code): (U)Evaluative and Consultative Biomedical and Ergonomic Support to Systems Development Programs.

12. SCIENTIFIC AND TECHNOLOGICAL AREAS: 013400 Psychology; 009400 Man-Machine Relations; 002400 Bioengineering

13. START DATE	14. ESTIMATED COMPLETION DATE	15. FUNDING AGENCY	16. PERFORMANCE METHOD
78 10	CONT	DA	C. In-House

17. CONTRACT/GRANT
a. DATES/EFFECTIVE: NA — EXPIRATION
b. NUMBER:
c. TYPE — d. AMOUNT:
e. KIND OF AWARD — f. CUM. AMT.

18. RESOURCES ESTIMATE	c. PROFESSIONAL MAN YRS	d. FUNDS (In thousands)
FISCAL YEAR PRECEDING 79	1.5	68
FISCAL YEAR CURRENT 80	0	0

19. RESPONSIBLE DOD ORGANIZATION
NAME: US Army Aeromedical Research Laboratory
ADDRESS: Fort Rucker, AL 36362

RESPONSIBLE INDIVIDUAL
NAME: Knapp, S. C. COL, Cdr
TELEPHONE: (205) 255-5107

20. PERFORMING ORGANIZATION
NAME: US Army Aeromedical Research Laboratory Field Research & Biomedical Applications Div, Ft Rucker, AL 36362
ADDRESS:

PRINCIPAL INVESTIGATOR (Furnish SSAN if U.S. Academic Institution)
NAME: Krueger, G. P., MAJ, MSC
TELEPHONE: (205) 255-3211
SOCIAL SECURITY ACCOUNT NUMBER

21. GENERAL USE
Foreign Intelligence Considered

ASSOCIATE INVESTIGATORS
NAME: Kimball, K. A., Ph.D., DAC
NAME: Chiou, W. C., Ph.D., DAC

22. KEYWORDS (Precede EACH with Security Classification Code): (U) Aviation Medicine; (U) Man-Machine Systems; (U) Aviation Safety; (U) Operator Performance; (U) Ergonomics

23. TECHNICAL OBJECTIVE. 24. APPROACH. 25. PROGRESS (Furnish individual paragraphs identified by number. Precede text of each with Security Classification Code.)

23. (U) To provide medically important information about the biomedical, ergonomic, and human factors associated with man-machine system design throughout various phases of the materiel acquisition cycle of Army aviation and ground vehicle equipment. To perform appropriate medical RDT&E tasks in support of DARCOM equipment developers, program managers, TRADOC systems managers, Army test and concept evaluation agencies and boards, and the materiel systems user community.

24. (U) The approach is to provide technical research inputs in the application of medical, ergonomic and bioengineering science data to equipment development programs. This includes providing medical input to conceptual development planning boards, collecting limited man-machine system performance data in support of operational and developmental test (OT and DT) programs and providing consultative and evaluative support to PM's, TSM's, the TRADOC Concept Evaluation Program and the Tri-Service group on Helicopter Medicine, Human Resources, and Human Factors Research Panel.

25. (U) 7810 - 7909. The following human factors efforts were completed and submitted as laboratory letter reports in FY 79: Bio-Optic and human factors evaluation of the OH-58C helicopter with improved flat plate canopy; (2) an evaluation of the lighting of the tactical air traffic control tower (TSW-7) for blackout and night vision goggles compatibility; (3) operational evaluation of cattlehide leather/nomex flyers gloves; (4) human factors evaluation of the AH-1 Cobra attack helicopter synthetic flight training system device 2B33; and (5) human factors in aviation safety--psychology, medicine and engineering. Due to a realignment of laboratory personnel within the division, this work unit will be terminated. Future work of this nature will be carried under work units 005 and 014--DA OG 0162 and DA OG 0165.

*Available to contractors upon originator's approval

DD FORM 1 MAR 68 1498 PREVIOUS EDITIONS OF THIS FORM ARE OBSOLETE. DD FORMS 1498A (NOV 71) AND 1498-1 1 MAR 68 FOR ARMY USE ARE OBSOLETE

RESEARCH AND TECHNOLOGY WORK UNIT SUMMARY

1. AGENCY ACCESSION	2. DATE OF SUMMARY	REPORT CONTROL SYMBOL
DA OC 6889	79 10 01	DD-DR&E(AR)636

3. DATE PREV SUMRY	4. KIND OF SUMMARY	5. SUMMARY SCTY	6. WORK SECURITY	7. REGRADING	8a. DISP'N INSTR'N	8b. SPECIFIC DATA-CONTRACTOR ACCESS	9. LEVEL OF SUM
78 10 01	H. TERMINATE	U	U	NA	NL	☒ YES ☐ NO	A. WORK UNIT

10. NO./CODES:	PROGRAM ELEMENT	PROJECT NUMBER	TASK AREA NUMBER	WORK UNIT NUMBER
a. PRIMARY	6.11.01 A	3A161101A91C	00	293
b. CONTRIBUTING				
c. CONTRIBUTING				

11. TITLE (Procede with Security Classification Code)

(U) Retinal and Extra-Retinal Factors in Visual Acquisition

12. SCIENTIFIC AND TECHNOLOGICAL AREAS

012000 Optics; 012900 Physiology

13. START DATE	14. ESTIMATED COMPLETION DATE	15. FUNDING AGENCY	16. PERFORMANCE METHOD
78 10	79 10	DA	C. In-House

17. CONTRACT/GRANT

a. DATES/EFFECTIVE: EXPIRATION:

b. NUMBER:

c. TYPE: d. AMOUNT:

e. KIND OF AWARD: f. CUM. AMT.

18. RESOURCES ESTIMATE	a. PROFESSIONAL MAN YRS	b. FUNDS (In thousands)
FISCAL YEAR PRECEDING 79	1.5	175
FISCAL YEAR CURRENT 80	0.0	0.0

19. RESPONSIBLE DOD ORGANIZATION

NAME: US Army Aeromedical Research Laboratory

ADDRESS: Fort Rucker, AL 36362

RESPONSIBLE INDIVIDUAL

NAME: Knapp, Stanley C., COL, CDR

TELEPHONE: (205) 255-5107

20. PERFORMING ORGANIZATION

NAME: US Army Aeromedical Research Lab
Human Tolerance & Survivability Div

ADDRESS: Fort Rucker, AL 36362

PRINCIPAL INVESTIGATOR (Furnish SSAN if U.S. Academic Institution)

NAME: Behar, I.

TELEPHONE: (205) 255-6808

SOCIAL SECURITY ACCOUNT NUMBER

21. GENERAL USE

Foreign Intelligence Considered

ASSOCIATE INVESTIGATORS

NAME: Holly, F. F., CPT

NAME: POC: DA

22. KEYWORDS (Precede EACH with Security Classification Code) (U) Visual Acquisition; (U) Retinal Adaptation; (U) Dynamic Acuity; (U) Visual Sensitivity; (U) Visual Field; (U) Oculomotor Factors; (U) Military Operations

23. TECHNICAL OBJECTIVE. 24. APPROACH, 25. PROGRESS (Furnish individual paragraphs identified by number. Precede text of each with Security Classification Code.)

23. (U) To evaluate the visual response mechansims that may influence the probability of visual acquisition of dynamic targets. Also, to be able to predict the sensitivity of the visual system in various parts of the visual field from a knowledge of the preceding adaptational regimen. These objectives have wide applicability in nearly all real-world military operations.

24. (U) Studies of visual target acquisition over a wide range of target velocities will be conducted to provide normative data on visual performance capability. The influence on performance limits of retinal factors (e.g., adaptational state) and extra-retinal factors (e.g., target parameters, oculomotor and organismic characteristics) will be assessed. Also, "real-world" adaptional environments will be simulated in the laboratory with respect to both the spatial and temporal distribution of the adapting illumination. The effect of these various adaptational regimens upon the sensitivity and temporal response of the visual system will be studied.

25. (U) 7810-7909 The luminance threshold for Landolt ring resolution in dark adapted observers was determined for targets presented tachistoscopically and dynamically at velocities from 10^0S^{-1} to 87^0S^{-1}. The dynamic luminance thresholds are elevated relative to the tachistoscopic conditions as target velocity increases and as target subtense decreases. The dark adaptation portion of this project evaluated the adaptational effects of red versus white lighting at low luminance levels. For retinal areas directly stimulated by adapting lights, red lighting was found to be superior even down to .001 fL. This project is discontinued. Research initiated on this project is continued on 1498 "Research of Visual Problems Medically Significant to the Army," DA OB 6981.

*Available to contractors upon originator's approval

DD FORM 1 MAR 66 1498 PREVIOUS EDITIONS OF THIS FORM ARE OBSOLETE AND 1498-1 1 MAR 66 FOR ARMY USE ARE OBSOLETE

Appendix B

Publications and Presentations in FY 79

Publications

Armstrong, Richard N. [and others]. 1978. Oculomotor performance of aviators during an autorotation maneuver in a helicopter simulator. In: Knapp, S. C., ed. *Operational helicopter aviation medicine*. London: Technical Editing and Reproduction, Ltd. p. 38-1--38-14. AGARD-CP-255.

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Holly, Franklin F. 1979. *Psychophysical considerations in display design.* Presented at the Tri-Service Panel on Night Vision Technology, 15-18 Jan 1979, San Diego, California.

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Appendix C

Laboratory Personnel Serving on Technical and Scientific Committees

Committee	Affiliation	Individual
AEROSPACE MEDICAL ASSOCIATION		
Scientific Program Committee	Member	COL S. C. Knapp
	Member	Dr. K. A. Kimball
AMERICAN NATIONAL STANDARDS INSTITUTE		
Z90.1 Helmet Committee	Member	COL S. C. Knapp
Z90.1 Helmet Subcommittee on Helmet Durability	Chairman	COL S. C. Knapp
Z80.1 Ophthalmic Lens Committee	Member	LTC J. K. Crosley
AIR STANDARDIZATION COORDINATING COMMITTEE (INTERNATIONAL)		
Working Party 61	Member	LTC D. D. Glick
	Member	LTC J. K. Crosley
DEPARTMENT OF DEFENSE		
Aircrew Station Standardization Panel (Tri-Service)	Member	LTC J. K. Crosley
	Member	CPT F. F. Holly
Group on Specification Problems and Standardization Actions on Audio Devices	Member	Mr. R. T. Camp, Jr.

Committee	Affiliation	Individual
Helicopter Research Coordinating Panel (Tri-Service)	Member Member	Dr. K. A. Kimball COL S. C. Knapp
Joint Services Panel on the Field of Night Vision Technology	Member	CPT R. Verona
Tri-Service Aeromedical Research Panel (TARP)	Chairman Member	COL S. C. Knapp LTC J. K. Crosley
Tri-Service Aerospace Medical Coordination Technical Working Group	Member	Mr. J. L. Haley, Jr.
Human Factors Engineering Technical Advisory Group (Tri-Service)	Member	Dr. K. A. Kimball
DEPARTMENT OF THE ARMY		
Aircraft Noise, Working Group (MIL-STD-8806)	Member	Mr. R. T. Camp, Jr.
Army Aviation Personnel Requirements for Sustained Operations, Sustained Advisory Group	Member	Dr. K. A. Kimball
Biomedical Engineering	Consultant to the Surgeon General	COL S. C. Knapp
Helicopter Medical Human Factors Engineering and Training/Selection Research Coordination Panel	Member	Dr. K. A. Kimball
Improved Lighting Systems for Army Aircraft	Member	CPT F. F. Holly
Noise Limits for Army Materiel, Working Group (MIL-STD-1474A)	Member	Mr. R. T. Camp, Jr.
Pilot Night Vision System Technical Team	Member	CPT R. Verona
FEDERAL AVIATION ADMINISTRATION		
Seat Committee	Member	COL S. C. Knapp

Committee	Affiliation	Individual
NATIONAL ACADEMY OF SCIENCES/ National Research Council		
Committee on Vision	Member	LTC D. D. Glick
Committee on Vision	Member	LTC J. K. Crosley
Committee on Vision	Member	MAJ R. W. Wiley
Committee on Vision	Member	Dr. I. Behar
Committee on Hearing and Bioacoustics	Member	Mr. R. T. Camp, Jr.
NORTH ATLANTIC TREATY ORGANIZATION Advisory Group for Aerospace R&D		
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Commander
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